MultiModemISDN™

# Model MTA128ST-USB
# External ISDN Terminal Adapter

## User Guide

MultiTech® Systems

# User Guide

Model MTA128ST-USB

P/N 88311700 Revision A

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# Contents

## Chapter 1 - Introduction and Description


Introduction ..... 6
Product Description ..... 6
Universal Serial Bus (USB) ..... 6
Manual Organization ..... 7
Features ..... 8
Technical Specifications ..... 9


## Chapter 2 - Hardware Installation


Introduction ..... 12
Unpacking Your MTA128ST-USB ..... 12
Safety Warning Telecom/ISDN-ST ..... 12
Assembling the MTA128ST-USB ..... 13
Connecting the MTA128ST-USB to Your System ..... 13
    Connecting to Your Computer ..... 14
    Connecting to Power ..... 14
    Connecting to Your ISDN Network Terminator ..... 14
    Connecting to Analog Equipment ..... 14
LED Indicators ..... 15
References ..... 16


## Chapter 3 - Software Installation and Configuration


Introduction ..... 18
    Driver Software Installation ..... 18
    Removing Your Old Device from Windows 98/95 ..... 21
Configuration ..... 21
    Network Configuration ..... 22
    Call Control Configuration ..... 23
    ISDN MTA128ST-USB Configuration Utility ..... 24
    Windows 98/95 Dial-Up Networking ..... 25
AT Commands ..... 25
    Using AT Commands to Configure the MTA128ST-USB ..... 25


## Chapter 4 - AT Commands, S-Registers and Result Codes


Introduction ..... 28
Entering AT Commands ..... 28
    AT Commands by Function ..... 29
    Data Call Commands ..... 41
S-Registers ..... 43
    S-Register Summary ..... 43
Result Codes ..... 57
Using AT Commands to Operate the MTA128ST-USB ..... 58
    Modes of Operation ..... 58
Making a Call ..... 58
    Dialing ..... 58
    Channel Bundling Flag Dialing ..... 59
    Canceling a Call ..... 59
    Storing a Telephone Number ..... 59
    Dialing a Stored Telephone Number ..... 59

Displaying a Stored Number ..... 59
Answering a Call ..... 60
Answering Manually ..... 60
Answering Automatically ..... 60
Hanging Up ..... 60

## Chapter 5 - Troubleshooting

Introduction ..... 62

## Chapter 6 - Warranty, Service, and Technical Support

Introduction ..... 70
Limited Warranty ..... 70
On-line Warranty Registration ..... 70
Technical Support ..... 71
Service ..... 71
The Multi-Tech BBS ..... 71
Logging on to the Multi-Tech BBS ..... 71
Downloading a File ..... 72
Reading a Message ..... 72
Leaving a Message ..... 72
Bulletins ..... 72
Upgrading the MTA128ST-USB with Flash Wizard ..... 73
Using FlashWizard to Upgrade Firmware ..... 73
Ordering Accessories ..... 74

## Appendixes

Appendix A: Regulatory Compliance ..... 76
FCC Part 15 ..... 76
Industry Canada ..... 76
EMC, Safety, and Terminal Directive Compliance ..... 77
Appendix B: Configuration Profiles ..... 78
Quick Setup Factory Profiles ..... 78
Quick Setup Example ..... 78

## Glossary

## Index

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# Chapter 1 - Introduction and Description

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# Introduction

Welcome to the world of data communications. You have acquired one of the finest ISDN terminal adapters (TA) available today from one of America's oldest and most respected modem manufacturers: Multi-Tech Systems, Inc. This user guide will help you install, configure, test and use your terminal adapter.

# Product Description

The MTA128ST-USB is a desktop terminal adapter with an ST port used for connection to the ISDN network, a USB port for connection to a PC or laptop, and an analog port to connect to a telephone, modem, or fax machine. It ships with a software configuration utility for Windows® 98 and Windows 95. In addition, the MTA128ST-USB accepts AT commands that enable it to use the same communications software as an analog modem.

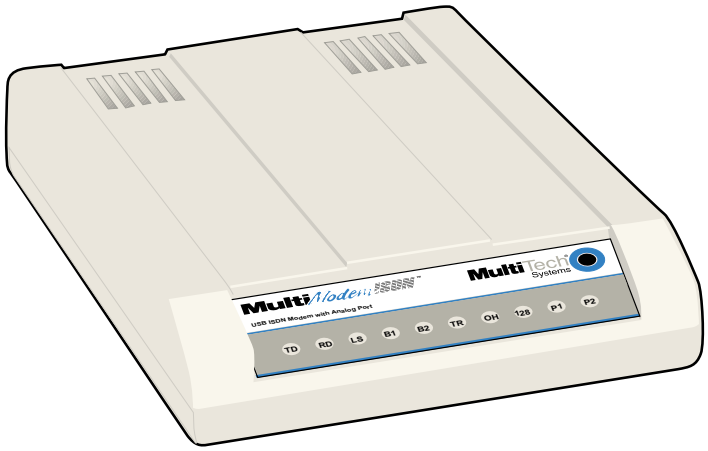


**Figure 1-1: MTA128ST-USB (Front View)**

The MTA128ST-USB is compatible with the popular EuroISDN switch protocol, it communicates using ISDN BRI (2B+D) service, which provides up to 128 Kbps data and voice communications, and it automatically detects whether an incoming call is voice or data and handles it appropriately.

# Universal Serial Bus (USB)

Universal Serial Bus (USB), defined by a consortium of industry leaders, permits connection of multiple low-speed and medium speed computer peripheral devices such as telephones, modems, printers, keyboards, mice, and scanners; all from a single personal computer port. The specification, based on open architecture has become a standard feature in new desktop and notebook computers.

For more details, refer to the USB Public Web Board on the World Wide Web at:

http://www.usb.org/

# Manual Organization

This manual is divided into six chapters and two appendixes:

***Chapter 1: Introduction and Description***—Summarizes product features, lists technical specifications, and provides an overview of manual's organization.

***Chapter 2: Installation***—Describes how to connect the MTA128ST-USB to the computer, to power, to the ISDN BRI line, and to an optional analog device. It also describes the functions of the front panel LED indicators.

***Chapter 3: Software Installation and Configuration*** —Describes how to install the driver software and how to configure and operate the MTA128ST-USB using the Windows 98/95 software configuration utility.

***Chapter 4: AT Commands, S-Registers, and Result Codes***—Describes how to use AT commands, S-registers, and result codes to control the MTA128ST-USB through popular communications programs.

***Chapter 5: Troubleshooting***—Provides tips and advice if you think your MTA128ST-USB isn't working correctly.

***Chapter 6: Warranty, Service, and Technical Support***—Provides terms of your warranty and describes how to get your MTA128ST-USB serviced at the factory, should that be necessary. It also describes how to upgrade your unit using the FlashPro utility, and how to get technical support and information by phone, the Multi-Tech BBS, and Internet forums.

***Appendix A: Regulatory Compliance***—EMC, Safety, and Terminal Directive Compliance.

***Appendix B: Configuration Profiles***—Describes how to use the Quick Setup Factory Profiles stored in the MTA128ST-USB's firmware and lists contents of each profile.

# Features

The MTA128ST-USB communicates over public ISDN telephone lines. Features include:

- Compatibility with EuroISDN (ETSI/DSS1/NET3), French VN4, and Japanese INS64 switch protocols
- USB interface for easy installation; hot-swappable (Windows 98) with other USB devices without restarting or reconfiguring your PC
- Compatibility with U.S. NI-1, AT&T 5ESS, and DMS-100 switch protocols
- Compatibility with V.110, V.120, ML-PPP, and X.75 protocols
- ISDN BRI (2B+D) and analog ports
- USB port (Type B)
- Support of PPP (Point-to-Point Protocol) for high speed ISDN connections
- Tone detection to allow use of a standard telephone for ISDN line access (an ISDN telephone is not required)
- Automatic detection of incoming calls as voice or data
- Windows 98/95 software utility and a firmware utility for easy ISDN line configuration
- AT commands, S-registers, and result codes
- Ability to use the same communications software as analog modems
- Flash memory for easy firmware upgrades

# Technical Specifications

Your MTA128ST-USB terminal adapter meets the following specifications:

| | |
|---|---|
| ***Trade Name*** | MultiModemISDN |
| ***Model Number*** | MTA128ST-USB (International) |
| ***Network Interface*** | Four-wire S/T interface |
| ***Switch Compatibility*** | EuroISDN (ETSI/DSS1/NET3), VN4, INS64, U.S. NI-1, AT&T 5ESS, DMS-100 |
| ***B-Channel Protocols*** | V.110, V.120, X.75, ML-PPP |
| ***Voice Coding*** | PCM: A-Law (Europe); µ-Law (US) |
| ***LED Indicators*** | 10 front panel LED indicators: Transmit Data, Receive Data, Call Status, B1 Active, B2 Active, Terminal Ready, Off Hook (AUX port), 128 Kbps, P1 Active (data protocol), P2 Active (data protocol) |
| ***Data Rates*** | 300, 1.2K, 2.4K, 4.8K, 9.6K, 19.2K, 38.4K, 56K, 57.6K, 64K, 115.2K, 230.4K, and 460.8K bps |
| ***Data Connections*** | Two ISDN B-channels<br>One ISDN D-channel<br>One analog port for connecting a standard telephone, modem, or fax machine |
| ***Command Interface*** | AT commands, S-registers, result codes, Windows 98/95 configuration utility, and Windows 98/95 Dial-Up Networking (DUN) |
| ***Connectors*** | USB: Type B connector<br>ISDN: RJ-45 female receptacle, 4-wire S/T (accepts connection cable to the network provider's NT1 device)<br>AUX: RJ-11 female receptacle |
| ***Switches*** | Two-position power switch |
| ***Power Requirements*** | Two-prong outlet-mounted transformer (included), 240 VAC 50/60 Hz |
| ***Dimensions*** | 15.0 cm × 10.7 cm × 2.8 cm (L × W × D) |
| ***Environmental*** | Temperature range 0°–50° C;<br>Humidity range 20–90% (noncondensing) |
| ***Power Consumption*** | 4 watts |
| ***Weight*** | 224 g (8 oz) |
| ***Warranty*** | 5 years |

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# Chapter 2 - Hardware Installation

MultiTech® Systems

# Introduction

This chapter details the contents of the MTA128ST-USB shipping container, describes each cable connection, and describes the LED indicators.

# Unpacking Your MTA128ST-USB

The shipping box contains the MTA128ST-USB, an external power supply, one RJ-45 line cord, one RJ-11 phone cord, one USB cable, your Quick Start Guide, and two diskettes (i.e., the MTA128ST-USB User Guide and the MTA128ST-USB Driver Software). Inspect the contents for signs of any shipping damage. If damage is observed, do not power up the unit; contact Multi-Tech's Technical Support for advice (refer to Chapter 6). If no damage is observed, place the MTA128ST-USB in its final location and refer to "Connecting the MTA128ST-USB to Your System" in the next section.

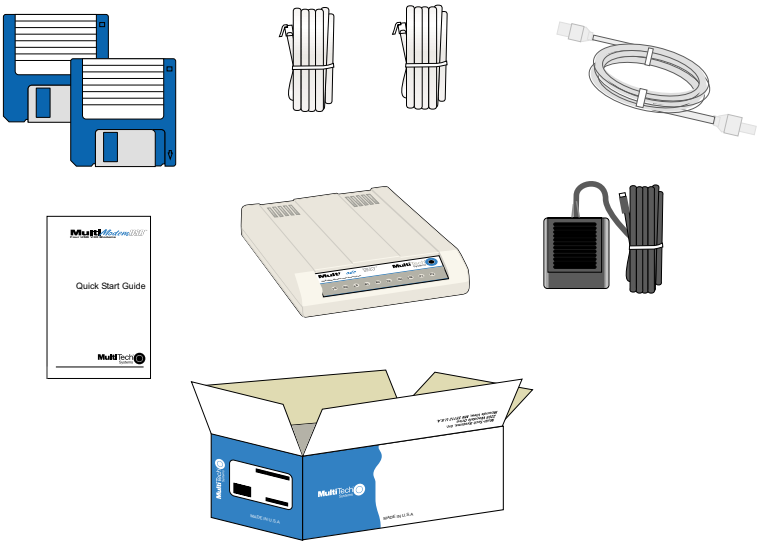


**Figure 2-1. Unpacking**

# Safety Warning Telecom/ISDN-ST

1. Never install telephone wiring during a lighting storm.
2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. This product is to be used with CE approved/marked computers.
4. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
5. Use caution when installing or modifying telephone lines.
6. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock from lightning.
7. Do not use the telephone to report a gas leak in the vicinity of the leak.
8. To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.
9. If S/T - interface ISDN network connection cable is used, the ISDN phone cord should be connected between the ISDN network connection cable and a NT1 device.

# Assembling the MTA128ST-USB

The only assembly required is to mount the feet on the bottom of your unit (See Figure 2-2). Peel the four self-adhesive plastic feet off the backing strip and press them into the recesses on the bottom.

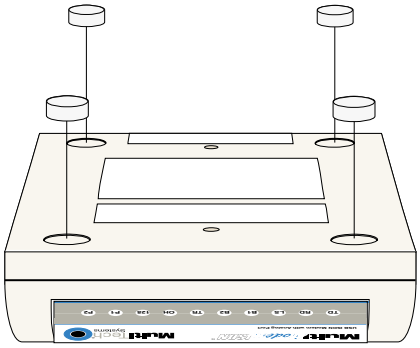

**Figure 2-2. Mounting the Feet**

# Connecting the MTA128ST-USB to Your System

Place the MTA128ST-USB terminal adapter in a convenient location. In a typical configuration, you will need to connect your MTA128ST-USB to your computer's USB port, to its own power supply, to the ISDN network terminator, and to any optional analog equipment you are using (e.g., a telephone). For each cabling procedure, see Figure 2-3.

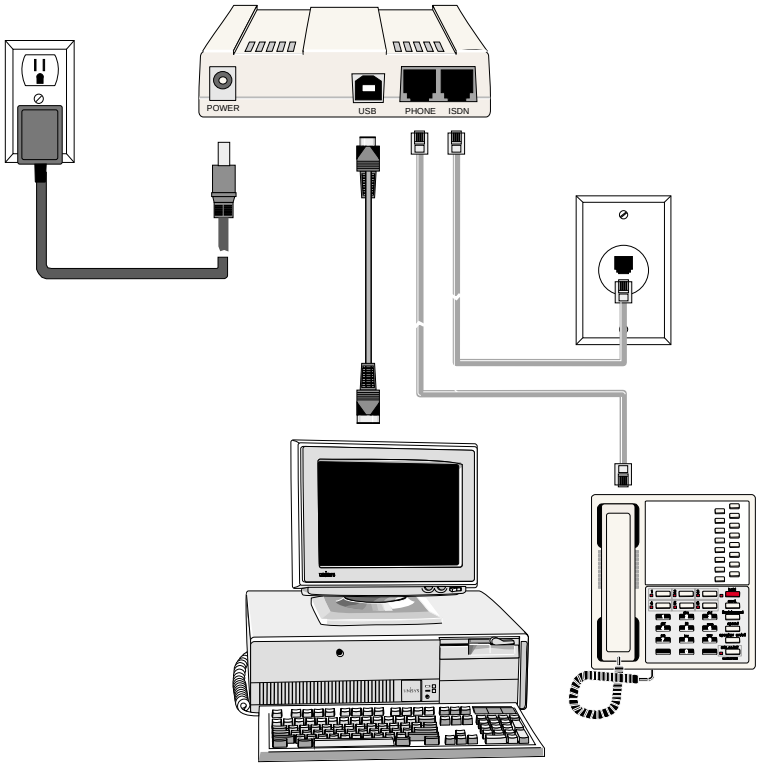


**Figure 2-3. MTA128ST-USB Connections**

## Connecting to Your Computer

1. Plug the 4-pin flat end (Type A) into a USB port connector on your computer or laptop.

***Note:*** *Do NOT plug the "D-shaped" end (Type B) of the USB cable into the USB connector on the back panel of the MTA128ST-USB at this time. You will make the connection at Step 2 when installing the software drivers.*

## Connecting to Power

1. Plug the power supply into the unit's POWER connector.
2. Plug the power supply into a live AC outlet.
3. Turn on the unit by sliding the power switch to ON.
4. Verify operation by observing the LED indicators on the front panel. The LEDs will initially flash in a self-test pattern. Then the LS LED remains on. (See LED descriptions on the next page.) If the terminal adapter does not appear to be working, see Chapter 5 for troubleshooting help.

***Caution:*** *Only use the power supply shipped with your MTA128ST-USB; any other power supply could damage the unit and void its warranty.*

## Connecting to Your ISDN Network Terminator

1. If you need a longer line cord than the RJ-45 line cord provided with your MTA128ST-USB, select a cord that is wired straight through (pin 1 to pin 1; pin 2 to pin 2, etc.) with at least the middle four pins connected (pins 2, 3, 4, and 5).
2. Plug one end of the provided RJ-45 S/T line cord into the ISDN jack on the MTA128ST-USB and the other end into the S/T jack on your network terminator.

***Note:*** *The AUX jack and ISDN jack are not interchangeable.*

## Connecting to Analog Equipment

You can connect an analog device such as an analog telephone, modem, or fax machine to the unit. Simply plug the device's modular RJ-11 telephone cord into the RJ-11 AUX connector.

***Note:*** *The AUX jack and the ISDN jack on the unit are not interchangeable.*

# LED Indicators

The ten LED indicators on the front panel (see Figure 2-4) of the MTA128ST-USB report status and line activity.

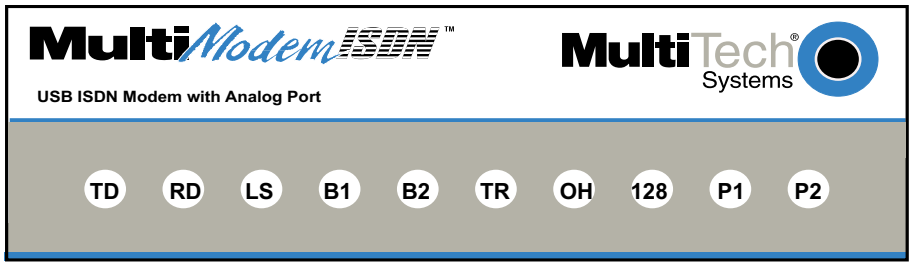


**Figure 2-4: Front Panel**

**TD** **Transmit Data**

Flashes when data is being transmitted (on for a space, off for a mark).

**RD** **Receive Data**

Flashes when data is being received (on for a space, off for a mark).

**LS** **Power**

Lights when the unit is turned on.

**B1** **Bearer Channel 1**

When lit, indicates active data or voice connection on bearer channel 1.

**B2** **Bearer Channel 2**

When lit, indicates active data or voice connection on bearer channel 2.

**TR** **Terminal Ready**

Lights to indicate that the computer is communicating with the MTA128ST-USB, so the MTA128ST-USB can answer an incoming call.

**OH** **Off Hook**

Lights when analog equipment on AUX port is active or off-hook.

**128** **128 Kbps**

Lights to indicate that the B channels have been multiplexed into a single 128 Kbps communications link.

**P1**

**Data Protocol**

Lights in combination with P2 and 128 LEDs to indicate which data protocol (V.110, V.120, X.75, PPP, MLPPP) is in use as shown in the table below.

**P2**

**Data Protocol**

Lights in combination with P1 and 128 LEDs to indicate which data protocol (V.110, V.120, X.75, PPP, MLPPP) is in use as shown below:

| Data Protocol | 128 LED | P1 LED | P2 LED |
|---|---|---|---|
| V.110 | ● | ● | ● |
| V.120 | ● | ● | ○ |
| X.75 | ● | ○ | ● |
| PPP (1 channel) | ● | ○ | ○ |
| MLPPP (2 channels) | ○ | ○ | ○ |

● OFF ○ ON

# References

The World Wide Web is an excellent source of information about terminal adapters in general and terminal adapter installation, configuration, and troubleshooting in particular. The following Web sites are good places to start:

- Costmo's Other Resources Page:
  http://modems.rosenet.net/or/
- Data Communications FAQ:
  http://www.best.com/~malch/comfaq.html
- Multi-Tech Systems, Inc.:
  http://www.multitech.com/

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# Chapter 3 - Software Installation and Configuration

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# Introduction

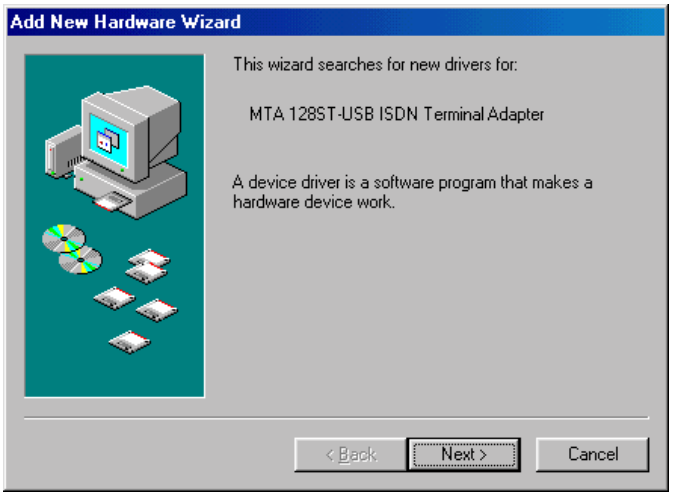
This chapter describes how to install the MTA128ST-USB driver software and discusses how to configure the unit to match your ISDN service and remote terminal adapter (TA).

## Driver Software Installation

MTA128ST-USB driver software is installed in Win 98 or Win 95 operating environments.

### *Installing in Windows 98*

1. Power up your Windows 98 system.
2. Turn on your MTA128ST-USB. The LS (Power) LED will light.
3. Plug the “D-shaped” end (Type B) of your USB cable into the USB connector on the back of the unit (See Figure 2-3).
4. Windows will detect that the new modem is present and launch the **Add New Hardware Wizard**.


Add New Hardware Wizard
This wizard searches for new drivers for:
MTA 128ST-USB ISDN Terminal Adapter
A device driver is a software program that makes a hardware device work.
< Back
Next >
Cancel

Place the Installation diskette provided with your modem into your floppy drive and click **Next >** to proceed with the installation.

5. The **Add New Hardware Wizard** dialog box is displayed.

Add New Hardware Wizard
What do you want Windows to do?
Search for the best driver for your device. (Recommended).
Display a list of all the drivers in a specific location, so you can select the driver you want.
< Back
Next >
Cancel

Verify that the “Search for the best driver for your device. (Recommended)” option is selected and click **Next >**.

6. The **Add New Hardware Wizard** dialog box is displayed.

Add New Hardware Wizard
Windows will search for new drivers in its driver database on your hard drive, and in any of the following selected locations. Click Next to start the search.
Floppy disk drives
CD-ROM drive
Microsoft Windows Update
Specify a location:
A:\
Browse...
< Back
Next >
Cancel

Verify that the “Floppy disk drives” option is selected and click **Next >**.

7. The **Add New Hardware Wizard** dialog box is displayed.

Add New Hardware Wizard
Windows driver file search for the device:
Multi-Tech MTA128ST-USB ISDN Terminal Adapter
Windows is now ready to install the best driver for this device. Click Back to select a different driver, or click Next to continue.
Location of driver:
A:\MCCISER.INF
< Back
Next >
Cancel

Windows will select the proper driver from the installation disk and will display the information for verification. Click **Next >** to install the selected driver.

8. Windows proceeds to copy the files to the system and then displays the **Add New Hardware Wizard** dialog box.

Add New Hardware Wizard
Multi-Tech MTA128ST-USB ISDN Terminal Adapter
Windows has finished installing the software that your new hardware device requires.
< Back
Finish
Cancel

Click **Finish** to complete the installation and exit the wizard.

*Note: Click **My Computer** | **Properties** | **Device Manager** to see if driver software was installed.*

### Modem Installation

After the driver software has been installed, you will need to install the appropriate modems. These are included on the driver disk shipped with your MTA128ST-USB.

1. Click **Start** | **Settings** | **Control panel** | **Modems**.
2. The **Modems Properties** dialog box is displayed.
3. From the General tab, click the **Add** button.
4. The **Install New Modem** dialog box is displayed. Ensure that the “Don’t detect my modem: I will select it” option is selected and click **Next >**.
5. The **Install New Modem** dialog box is displayed listing the Manufacturer and Model options. Click the **Have Disk** button and select the appropriate models (MTA128ST-USB Auto-Protocol, MTA128ST-USB Multi Link PPP, MTA128ST-USB PPP async, MTA128ST-USB V.110 async, MTA128ST-USB V.120 async, and MTA128ST-USB X.75 async), and then click **Next >**.
6. The **Install New Modem** dialog box is displayed indicating that your modem(s) have been set up successfully.

*Note: Once you have completed the installation, check to see that the modem(s) has been added to the Modems list. Click **Start** | **Settings** | **Control Panel**. Then double click the **Modems** icon and check to see if they were installed.*

## *Installing in Windows 95*

Only certain versions of Windows 95 (OSR2.1, Revision C) offer support for USB peripherals. If you are unsure if your Windows 95 system supports USB, a free USB evaluation utility is available from the Shopping Bag page at http://www.usb.org. Download the utility (287K) and run the .exe application to determine if you have USB support.

If you would like to install your MTA128ST-USB in Windows 95, do the following:

1. Power up your Windows 95 system.
2. Turn on your MTA128ST-USB. The LS (Power) LED will light.
3. Plug the “D-shaped” end (Type B) of your USB cable into the USB connector on the back of the unit (See Figure 2-3).
4. Windows will detect that the new modem is present and launch the **Update Device Driver Wizard**. Click **Next >** to proceed with the installation.
5. Windows searches for the driver on A:\ and, when identified, will display the driver name for verification. Click **Finish** to install the driver.
6. Windows prompts you to insert a diskette. Insert it and click **OK** to continue. The **Copy Files ...** dialog box is displayed. In the **Copy files from** field, choose **A:** from the drop-down list and click **OK**.
7. When the driver is installed, a completion message will appear and the wizard will exit. At this time your installation is complete.

*Note: Once you have completed driver software installation, you need to install the appropriate modem(s). The installation procedure is the same as the procedure in Windows 98. Once installed, check to see that the modem(s) has been added to the Modems list. Click **Start** | **Settings** | **Control Panel** and double click the **Modems** icon to see if they were installed.*

## Removing Your Old Device from Windows 98/95

When your new MTA128ST-USB replaces another terminal adapter, the old installation remains in Windows 98/95 after you install the new device, and the old device is still selected in HyperTerminal and other Windows 98/95 applications. Although you can change the application connection descriptions one at a time, it is easier to force Windows applications to use the new device by removing the old modem from Windows.

1. Click **Start | Settings | Control Panel**.
2. Double-click the **Modems** icon to display the **Modems Properties** dialog box.
3. In the list box, select (highlight) the device to be deleted.
4. Click **Remove** and then click **Close** to remove the device from your system.
5. The next time you dial a HyperTerminal connection, it will select your new device and ask you to confirm the selection.

# Configuration

Run the ISDN MTA128ST-USB configuration utility for North American customized ISDN settings.

---

***Note:*** *For Europe, run the configuration utility to customize the settings of the terminal adapter; for example, to configure Multiple Subscriber Numbers (MSNs).*

---

Configure the unit to match your ISDN service and the remote terminal adapter (TA) with any of three methods listed below:

- ***ISDN MTA128ST-USB Configuration Utility***
  This configuration utility is recommended for computers running Windows 98/95 operating systems. Because it is a software-based utility, you can use it to create and store as many configurations as you want.
- ***Windows 98/95 Dial-Up Networking***
  With Dial-Up Networking you can gain access to shared information on another computer, even if your computer is not on a network. The computer you are dialing in to must be set up as a network server for you to use its shared resources. Windows 98/95 includes a remote-node client called Dial-Up Networking (DUN). The MTA128ST-USB can be used with this client for data communications.
- ***AT Commands***
  If you prefer using AT commands or want to fine tune the operation of your unit, configure your unit by using AT commands and S-registers much as you would configure an analog modem. Enter these commands in your data communication program's terminal mode. AT commands are described in detail in Chapter 4.

Whatever method you use to configure your MTA128ST-USB, consider your network and call control configuration choices beforehand and record your choices. Refer to them during the configuration procedure.

## Network Configuration

***Network Switch Type*** _____

Select the network switch type your ISDN service provider uses at its local central office. You can set the MTA128ST-USB to NET3 (DSS1), VN4, INS64, U.S. NI-1, AT&T 5ESS, or DMS-100. If you don't know the switch type, get the information from your ISDN service provider. *AT command:* ***!C0=***

***Data TEI*** _____

Data TEI (Terminal Endpoint Identifier) is the TEI assigned to the data channel. You can select Auto TEI, a fixed TEI, or Disable. A TEI is a number used by the central office switch to uniquely identify each device connected to the network. When it uses dynamic TEI assignments (Auto TEI), the central office switch assigns a TEI each time the unit connects to the network. However, the ISDN service provider may assign a fixed TEI at subscription time, in which case you must configure the unit with the fixed TEI number. You can also disable the channel, which may be useful when multiple units are attached to a network terminator bus. *AT command:* ***!D3=***

***Voice TEI*** _____

Voice TEI is the TEI assigned to the voice channel. Choices are: Auto TEI, a fixed TEI number, or Disable. *AT command:* ****!D3=****.*

***Data MSN*** _____

The Data MSN (Multiple Subscriber Number) allows a caller to specify an individual MTA128ST-USB when more than one unit is connected to your network terminator. If you don't assign a value to the MSN, the unit accepts all incoming calls. If you only assign a base address to the MSN, the unit accepts any incoming call with the same base address, regardless of whether a subaddress is included. If you assign a base address and a subaddress to the MSN, the unit only accepts calls that match both the base address and the subaddress. The following examples show the syntax for setting the MSN with and without a subaddress. *AT command:* ***!N1=***

**MSN with subaddress:** AT!N1=5551000:001 (base address is 5551000; subaddress is 001)

**MSN without subaddress: A**T!N1=5551000 (base address is 5551000)

***Voice MSN*** _____

Selects calls on the voice channel in the same way the Data MSN selects calls on the data channel. *AT command:* ****!N1=***

***SPIDs and DNs*** _____

For use with North American switches, the Service Profile Identifier (SPID) must be configured in the MTA128ST-USB. The SPID is assigned by the local phone company and is for the specific BRI line where the unit is attached. The SPID field is empty prior to configuration.
*AT commands*: **AT!C6=** and **AT*!C6=**

Directory Number (DN) is the phone number another user calls to contact this unit once it is attached to the ISDN.
*AT commands*: **AT!N1=** and **AT*!N1=**

**Note:** SPIDs and DNs are used only by the U.S. NI-1, AT&T 5ESS, and DMS-100 switch types.

## Call Control Configuration

***Persistent DTR Dialing*** _____

A high DTR (Data Terminal Ready) signal on the USB port indicates your computer or terminal is ready to communicate with your MTA128ST-USB. DTR normally goes high when a communication program starts or is ready to dial. Persistent DTR dialing enables the unit to automatically redial the number stored in memory location 0 whenever DTR is high and the USB port does not have an active call. You can enable or disable this feature. *AT command:* ***$D****.*

***Auto Answer Data Calls*** _____ ***Rings to Answer*** _____

Select Auto Answer if you want your MTA128ST-USB to automatically answer all incoming data calls (this option does not affect the analog port). The Rings to Answer number, in the range of 1 to 255, selects the number of rings the unit waits before answering an incoming call. The default is one ring. *AT command:* ***S0=***

***Dialing Method*** _____

Select either the Enbloc or the Overlap dialing method for use when establishing a data call. Your ISDN provider determines the dialing method. The Enbloc method is used for most ISDN dialing; however, you can select the overlap method if you are working with a private network. *AT command:* ***%A97=***

***Data Protocol*** _____

The data protocol, also known as the B-channel protocol and the rate adaption protocol, is the *language spoken* over each 64 Kbps channel between two ISDN devices. The devices on both ends of the ISDN link must use identical protocols. *AT command:* ***!Z=***

- **V.110 Protocol**—Used to connect slower, pre-ISDN communications devices to high-speed ISDN lines. It handles rates up to only 38400 bps and is used mostly in Europe. The devices on both ends of the link must be set to identical rates. However, the MTA128ST-USB (by default) is able to adapt to the network rate of a received V.110 call even though it has S76 or $MB set to a different network rate.
- **V.120 Protocol**—Similar to V.110 protocol, but provides rates up to 64000 bps on each B channel.
- **X.75 Protocol**—Packet-switched network protocol for international use. Layer 2 portion of this protocol is used commonly as a rate adaption protocol.
- **MLPPP Protocol**—MLPPP (Multi-Link PPP) protocol provides rates up to 64 Kbps per channel. This protocol uses both B channels at once, providing an aggregate data transmission speed of 128 Kbps.

***Dialing Numbers*** _____

The MTA128ST-USB can dial telephone number *n*, where *n* can be up to 20 characters. *AT command:* ***Dn*** (*n* = phone number).

***Stored Numbers*** _____

The MTA128ST-USB can store as many as ten phone numbers, up to 20 characters each. *AT command:* ***&Z=***

***Dialing Stored Numbers*** _____

The MTA128ST-USB can dial a number previously stored in directory number *n* with the ***&Zn=x*** command. *AT command:* ***e.g., DSn***

# ISDN MTA128ST-USB Configuration Utility

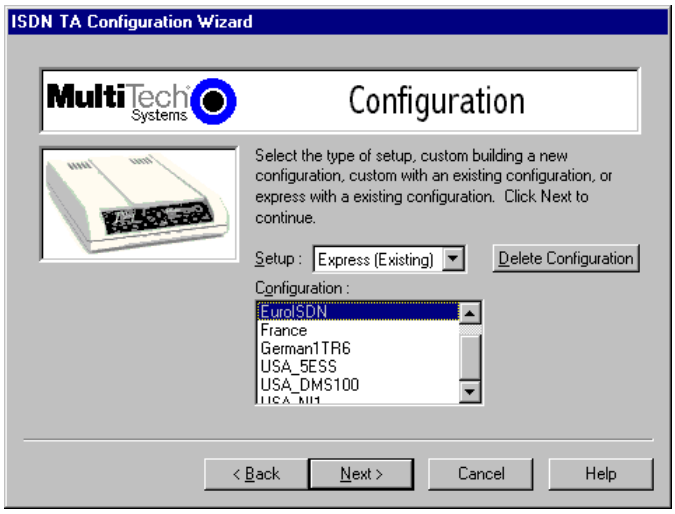
Use the ISDN MTA128ST-USB Configuration Utility with computers running Windows 98/95 operating systems only. Because it is a software utility, you can use it to create and store as many different configurations as you wish.

## *To Install in Windows 98/95*

1. When installing from disk, insert the Setup disk (provided in your MTA128ST-USB package) into drive A or B. If installing from a network location, connect to it. (Note the drive letter. You may need it if you run Setup again.)
2. Click **Start**, **Settings**, and then click **Control Panel**.
3. Double-click the **Add/Remove Programs** icon.
4. In the *Install/Uninstall* tab, click **Install**.
5. Follow the instructions that appear on screen.

## *To Use the ISDN MTA128ST-USB Configuration Utility*

1. To start the utility, click **Start**, **Programs**, and then double-click the ISDN MTA128ST-USB Configuration Utility icon. The **ISDN TA Configuration Wizard** is displayed.




   Select the type of Setup (e.g., Express (Existing), Configuration (e.g., EuroISDN), and then click **Next >**. Follow the instructions provided in each succeeding dialog box.

2. Refer to the “Network Configuration” topic notes in the previous section as you configure the unit. If you have questions about choices in a dialog box, click **Help**.
3. When you finish configuring the MTA128ST-USB, exit the configuration utility.

## Windows 98/95 Dial-Up Networking

Windows 98/95 includes a remote-node client called Dial-Up Networking (DUN).

### *To install and operate Dial-Up Networking*

1. Insert the Windows 98/95 CD-ROM into the CD ROM drive.
2. In Windows 98/95, click **Start | Settings** | **Control Panel** | **Add/Remove Programs**.
3. Click the **Windows Setup** tab.
4. In the **Components** list, select **Communications**; then click **Details**.
5. In the **Components** list, select **Dial-up Networking**; then click **OK**. Your client computer accesses the Windows 98/95 CD-ROM.
6. When the installation is complete, reboot the client computer.
7. Double-click the **My Computer** icon.
8. Double-click the **Dial-Up Networking** icon.
9. Double-click the **Make New Connection** icon. When the connection is made, your Windows 98/95 client is ready to dial up a remote access server.

For additional information on Dial-Up Networking, see Windows 98/95 Help.

# AT Commands

You can configure the MTA128ST-USB by using AT commands, just as you would configure an analog modem. Use this method if you prefer to work with AT commands or if you have a special requirement not addressed by either of the configuration utilities.

## Using AT Commands to Configure the MTA128ST-USB

1. Connect the MTA128ST-USB to the USB port on your PC.
2. Turn on the MTA128ST-USB. Once the drivers are installed, Windows 98/95 will automatically detect the presence of the MT128ST-USB and activate the associated COM port.
3. Start a data communication program and select the COM port where the MTA128ST-USB is connected.
4. Referring to the *Configuration* section, enter the desired AT commands in the terminal window of the data communications program.
5. When you finish making changes, use the ***&W*** command to save your new configuration and to select it to automatically load when the MTA128ST-USB is turned on.
6. Quit the data communications program.

For more information on AT commands, refer Chapter 4.

MultiModemISDN™

# Chapter 4 - AT Commands, S-Registers and Result Codes

MultiTech® Systems

# Introduction

One of the ways you can communicate with and configure your MTA128ST-USB is to use AT commands. AT commands are so-called because, with only a few exceptions, each command string begins with the characters *AT*. Using AT commands, you can read and set parameters, and perform actions such as dialing.

**Note**: For purposes of brevity, the MTA128ST-USB is referred to as the TA (terminal adapter) throughout this chapter.

# Entering AT Commands

If your MTA128ST-USB (TA) is connected to a computer terminal, you can send AT commands to it by entering them on the keyboard. If the TA is connected to a computer, you can send AT commands to it by typing them in the terminal window of a data communications program such as HyperTerminal. You can also send some AT commands indirectly by configuring your data communications program.

To enter AT commands, use the following format: ***AT <command string> <cr>***. The characters *AT* cause the TA to interpret the following string as a command. The command string consists of one or more commands. The carriage return character, <cr>, sends the command string to the TA. If you are entering a command string in your communication program's terminal window, insert the carriage return character by pressing the ENTER key on your keyboard. If configuring a communications program, you typically must insert the carriage return character by adding ^M to the end of the command string.

The TA has three modes of operation: off-line command mode (the default state), on-line command mode, and data mode. The TA responds to AT commands only when it is in one of the command modes. After the TA establishes a connection and goes on-line in data mode, it interprets any further characters you enter as data rather than as commands and transmits them to the remote device.

When the TA is in data mode, you can switch it to on-line command mode by sending it an *escape sequence*. The TA responds to two types of escape sequences:

- *In-band* where the escape sequence is part of the data stream.
  The in-band escape sequence is ***+++AT<cr>***. To change the in-band escape character (+), change the value in register ***S2***.
- *Out-of-band* where the escape sequence is outside the data stream. The out-of-band escape sequence is ***<break >AT<cr>***. You can send the break signal in the out-of-band escape sequence only from software, *not* by pressing SHIFT+BREAK on your keyboard.

When it detects the escape sequence, the TA enters on-line command mode where it responds to commands while maintaining the connection with the remote device.

The TA's command buffer can store 80 characters, including spaces and other characters used in telephone numbers. If you mistype a command string, edit it by using the backspace or the delete key but only before you press ENTER. As you type a command string, it appears on your monitor screen, letting you verify your input as you type it.

The AT commands recognized by the TA are listed by function in this chapter first in an abbreviated list, followed by a more detailed list. For an alphabetical list of AT commands, see *AT commands* in the index.

# AT Commands by Function

## *Command Implementation*

| | |
|---|---|
| AT | Attention code |
| Return | Command execution |
| +++AT<cr> | In-band escape code |
| <break>AT<cr> | Out-of-band escape code |

| ***Switch*** | ***Configuration*** |
|---|---|
| %A97 | Dialing method |
| !C0 | Switch type |
| !C6 | Data SPID |
| *!C6 | Voice SPID |
| !D3 | SAPI-0 data TEI |
| *!D3 | SAPI-0 voice TEI |
| !L | List DN, SPID, TEI, Data protocol & switch type |
| >Dn | Embedded Protocol Analyzer |
| !N1 | Data DN/MSN 1 |
| !N2 | Data DN/MSN 2 |
| *!N1 | Voice DN/MSN |
| !RXG | Receive gain |
| !TXG | Transmit gain |
| !Z=n | Rate adaptation protocol |

***USB Port Configuration***

| | |
|---|---|
| En | Command mode echo |
| L | List telephone numbers |
| L5 | List current operating parameters |
| L6 | List S-register values |
| L8 | Display ISDN status |
| Qn | Status displays |
| Sr=n | Set S-register |
| Sr? | Read S-register |
| Vn | Terse/verbose result codes |
| Xn | Connect messages |
| Zn | Restore parameters to current power-up profile |
| &Cn | DCD (Data Carrier Detect) control |
| &Dn | DTR (Data Terminal Ready) control |
| &En | Flow control |
| #Xn | Send Single Multiple Xoff Characters |
| &Fn | Load quick setup factory profile |
| &Mn | Asynchronous/Synchronous mode |
| &Rn | CTS (Clear To Send) control |
| &Sn | DSR (Data Set Ready) control |
| &Wn | Store active profile |
| &Zn= | Store telephone number |
| &Jn | Automatic Channel Bundling |
| $Dn | Persistent DTR dialing |
| %En | Escape sequence options |

***Data Call Commands***

| | |
|---|---|
| A | Answer |
| D | Dial |
| DSn | Dial Stored telephone number |
| &Jn | Channel Bundling |
| H | Hang up |
| In | Display product information |
| On | Return on-line |
| @Config | Start ConfigMenu |

## *Command Implementation*

Command: **AT**
Function: Attention Code
Values: n/a
Default: n/a
Description: The attention code precedes all command strings except the **A/** command and escape codes.

Command: **RETURN**
Function: Command Execution
Default: n/a
Values: n/a
Description: Press RETURN (ENTER) to execute a command. In command examples, RETURN frequently is abbreviated <cr>.

Command: **+++AT<cr>**
Function: In-Band Escape Code
Values: ASCII
Default: + (43)
Description: Makes TA enter command mode (without disconnecting the call) when it is on-line with a remote device. Default escape code is three + characters followed by the letters *AT*, up to 80 command characters and a RETURN (press Enter). The TA escapes to command mode, executes any commands in the string, and then remains in command mode. Use ***S2=*** command to change the escape character.

Command: ***<break>AT<cr>***
Function: Out-of-Band Escape Code
Values: n/a
Default: n/a
Description: Places TA in command mode while remaining on-line. Enter a break signal, the letters *AT,* up to 80 command characters, and a RETURN (press Enter).

## *Switch Configuration Commands*

Use the following commands to select your network switch type (e.g., EuroISDN Net3) and to specify other information required to make an ISDN connection.

Command: **%A97=n**
Function: Dialing Method
Values: n = 0 or 1
Default: **%A97=0** (En bloc)
Description: Standardized ISDN signaling protocols such as DSS1, DSS2, and SS7 support *sending complete indication,* (a signal that no more digits follow). Adding this signal to a telephone number often is impractical. Therefore, many private networks send the number of a called party using a procedure called *overlap sending*, where no sending complete indication is sent. Computer users can automatically add the sending complete indication to a telephone number by choosing the en bloc method of sending, which results in faster call setup. Use the **%A97=** command to select between the two methods.

| | |
|---|---|
| **%A97=0** | En bloc sending during call SETUP |
| **%A97=1** | Overlap sending during call SETUP |

Command: **!C0=n**
Function: Network Switch Type
Values: n = 0, 1, 2, 4, 5, or 6
Default: **!C0=2** (Net3)
Description: Use the **!C0=** command to select one of the six network switch types supported by the TA. Factory default setting is **!C0=2** (NET3).

| | |
|---|---|
| **!C0=0** | AT&T 5ESS |
| **!C0=1** | Northern Telecom DMS-100 |
| **!C0=2** | EuroISDN NET3 |
| **!C0=4** | INS64 |
| **!C0=5** | US NI-1 |
| **!C0=6** | VN4 |

Command: **!C6=n**
Function: Data SPID
Values: n = 0–20 character string
Default: null string
Description: Use **!C6=** to specify the data service profile identifier (SPID) that the ISDN service provider assigned at subscription time. The data SPID string can have up to 20 characters. This command is not used if the switch type is set to NET3.

**Note:** For DMS-100 switches, any ASCII character except the underline (_) character is valid. For NI-1 and AT&T switches, only the digits 0–9 are valid.

Command: ***!C6=n**
Function: Voice SPID
Values: n = 0- to 20 character string
Default: null string
Description: Use ***!C6=** to specify the voice service profile identifier (SPID) that the ISDN service provider assigned at subscription time. The voice SPID string can have up to 20 characters. It is not used if the switch type is set to NET3.

**Note:** For DMS-100 switches, any ASCII character except the underline (_) character is valid. For NI-1 and AT&T switches, only the digits 0–9 are valid.

Command: **!D3=n**
Function: SAPI-0 Data TEI
Values: n = 0–63, 240 (auto), 241 (disable)
Default: **!D3=240** (Auto TEI)
Description: Use **!D3=** to set the terminal endpoint identifier (TEI) for the data channel. A TEI is a number used by the central office switch to identify uniquely each device connected to the network. When it uses dynamic TEI assignments (auto TEI), the central office switch assigns a TEI each time the TA connects to the network. However, the ISDN service provider may assign a fixed TEI at subscription time, in which case you must configure the TA with the fixed TEI number. You also can use **!D3=** to disable the data channel, which may be useful when multiple TAs are attached to a network terminator bus.

| | |
|---|---|
| **!D3=0–63** | Sets TEI to a fixed value from 0–63 |
| **!D3=240** | Sets data channel for dynamic TEI negotiation |
| **!D3=241** | Disables TEI |

Command: ***!D3=n**
Function: SAPI-0 Voice TEI
Values: n = 0–63, 240 (auto), 241 (disable)
Default: ***!D3=240** (Auto TEI)
Description: Use ***!D3=** to set the TA's terminal endpoint identifier (TEI) for the voice channel. See the **!D3=** command description.

| | |
|---|---|
| ***!D3=0–63** | Sets TEI to a fixed value from 0–63 |
| ***!D3=240** | Sets voice channel for dynamic TEI negotiation (default) |
| ***!D3=241** | Disables TEI |

Command: **!L**
Function: Display Network Configuration
Values: n/a
Default: n/a
Description: Use **!L** to display the TA's current DN, SPID, TEI, Data protocol, switch type.

| | |
|---|---|
| **!L** | Displays current network configuration |

Command: **>Dn**
Function: Embedded Protocol Analyzer
Values: 0, 1, 2, 3, 4, 5, 6, 98, or 99
Default: n/a
Description: The embedded protocol analyzer records and analyzes various protocols on B-channel, D-channel and DTE-DCE interface. The embedded protocol analyzer is useful as a diagnostic tool in that essential data messages display, which offers the ability to observe interactive operations of the TA, Central Exchange, and remote communications equipment.

| | |
|---|---|
| **>D0** | Display B-channel traffic, decoded as V.120 |
| **>D1** | Display D-channel traffic, decoding layers 2 and 3 (Q.921 and Q.931) |
| **>D2** | Display D-channel traffic, decoding layer 2 only (Q.921) |
| **>D3** | Display D-channel traffic, decoding layer 3 only (Q.931) |
| **>D4** | Display B-channel traffic, decoded as X.75 |
| **>D5** | Display RS-232 traffic, decoded as PPP |
| **>D6** | Display B-channel traffic, decoded as PPP |
| **>D98** | Disable embedded protocol analyzer, buffered data unchanged |
| **>D99** | Enable embedded protocol analyzer, clearing buffered data |

Command: **!N1=n**
Function: Data DN/MSN 1
Values: n = 25 character string
Default: null string
Description: **!N1** sets the Directory Number (DN)/Multiple Subscriber Number (MSN) for the data channel. The DN/MSN is a telephone number assigned to the TA at subscription time by the ISDN service provider. The DN/MSN is a string of up to 25 characters; valid characters are 0–9, the * character, and the # character.

Command: **!N2=n**
Function: Data DN/MSN 2
Values: n=25-character string
Default: Null string
Description: Data DN/MSN 2 accommodates the functionality for handling acceptance of incoming data. Data DN/MSN 2 can be set to the same value as the Voice DN/MSN or Data DN/MSN 1. See the **!N1=** command description.
***Note:*** *If using the TA as a host for MultiLink PPP calls with the MP+ Dynamic Bandwidth Allocation scheme (S59=1), Data DN/MSN 2 must be entered.*

Command: ***!N1=n**
Function: Voice DN/MSN
Values: n = 25 character string
Default: null string
Description: Sets the DN/MSN for the voice channel. See the **!N1=** command description.

Command: **!RXGn**
Function: Receive Gain
Values: n = 0–10
Default: **!RXG6** (medium volume)
Description: Use **!RXG** to control the speaker level of an analog telephone device connected to the AUX port. **AT!RXG0** selects the lowest level, **AT!RXG10** selects the highest level, and intermediate numbers select intermediate levels.

| | |
|---|---|
| **!RXG0** | Lowest speaker volume |
| through | |
| **!RXG10** | Highest speaker volume |

Command: **!TXGn**
Function: Transmit Gain
Values: n = 0–4
Default: **!TXG0** (No amplification)
Description: Use **!TXG** to amplify the microphone output of an analog telephone device connected to the AUX port. **AT!TXG0** selects no amplification, **AT!TXG4** selects the highest amplification, and intermediate numbers select intermediate amplification.
**CAUTION:** Do not adjust the gain unless absolutely necessary. It is very large at nonzero levels. Adjust only for special equipment that provides very low-level signals to the analog port.

| | |
|---|---|
| **!TXG0** | No microphone amplification |
| through | |
| **!TXG4** | Highest microphone amplification |

Command: **!Z=n**
Function: Rate Adaption Protocol
Values: n = 5, 6, 9, or 12
Default: **!Z=9** (ML-PPP)
Description: Selects rate adaption protocol used to communicate with another TA. The local and remote terminal adapters must be set to the same protocol for communication to take place.

| | |
|---|---|
| **!Z=5** | V.120 protocol |
| **!Z=6** | V.110 protocol |
| **!Z=9** | ML-PPP protocol |
| **!Z=12** | X.75 protocol |

### *USB Port Configuration Commands*

Use the following commands to control the interaction between the MTA128ST-USB and the computer that is connected to it.

Command: **En**
Function: Command Mode Echo
Values: n = 0 or 1
Default: **E1** (Echo on)
Description: When you enter commands on the keyboard, the TA echoes the characters back to the computer or terminal where they display on the monitor. Use **E** to turn this feature on and off.

| | |
|---|---|
| **E0** | Echo off |
| **E1** | Echo on |

Command: **L5** and **L6**
Function: List Active Profile
Values: n = 5 or 6
Default: none
Description: Lists current operating parameters of the TA, which is useful when changing communications software or changing default settings. **ATL5** lists AT command parameters, and **ATL6** lists values currently stored in the S-registers. (See *S-Registers* in this chapter for more information).

Command: **L8**
Function: Display ISDN Status
Values: none
Default: none
Description: Displays low level ISDN status for determining whether the physical layer is ready, whether the data link layer is ready, what caused a previous disconnect (Busy, Congestion, Normal Call Clearing, etc.) , and whether (for North American switch types) SPID numbers have been set up properly (SPID INCORRECT or SPID CORRECT).

Command: **Qn**
Function: Enable/Disable Result Codes
Values: n = 0, 1, or 2
Default: **Q0** (Enable result codes)
Description: Controls whether the TA sends result codes to the computer. (Use **V** to select result code format.)

| | |
|---|---|
| **Q0** | Enable result codes. |
| **Q1** | Disable result codes (quiet mode) for applications such as computer-controlled auto dialing. |

Command: **Sr=n**
Function: Set Register Value
Values: r = S-register number; n varies
Default: None
Description: Use **Sr=n** to set value of an S-register, where **r** is the number of the S-register, and **n** is the value you want to set. See *S-Registers* in this chapter for more information.

Command: **Sr?**
Function: Read Register Value
Values: r = S-register number
Default: None
Description: Use **Sr?** to read the value of an S-register, where **r** is the number of the S-register. See *S-Registers* in this chapter for further information.

Command: **Vn**
Function: Terse/Verbose Result Codes
Values: n = 0 or 1
Default: **V1** (Verbose)
Description: Use **V** to control whether the TA's result codes display as digits (terse) or as words (verbose). (Use **Q** to enable or disable the display of result codes.)

- **V0** Enable terse result codes.
- **V1** Enable verbose result codes.

Command: **Xn**
Function: Connect Messages
Values: n = 0, 1, 2, or 3
Default: **X2** (Enable all messages)
Description: Use **X** to select which result code messages the TA sends to the computer.

- **X0** Enables messages OK, CONNECT, RING, NO CARRIER, and ERROR (terse result codes 0–4).
- **X1** Enables all messages except BUSY (terse result codes 0–5, 10–14, 17–19, 28, and 32). If a call is placed to a busy line, the message NO CARRIER displays.
- **X2** Enable all messages (terse result codes 0–5, 7, 10–14, 17–19, 28, and 32).
- **X3** Enables all messages EXCEPT it does NOT print protocol messages. For example, for a V.120 connection, X2 prints:

  CONNECT 64000/V.120

  For a V.120 connection, X3 prints only the connect message (and speed):

  CONNECT 64000

Command: **Zn**
Function: Reset to Stored Profile
Values: none
Default: none
Description: Resets TA to its current power-up profile and clears the command buffer. The result is the same as turning the modem off and on. When you enter **ATZ**, the state of the **&W** command determines where the default values originate. The **&W0** defaults come from the customized configuration in NVRAM, and **&W1** defaults come from the factory default configuration in ROM. Because **Z** clears the command buffer, it must be the last command in a command string; normally it is issued by itself: **ATZ**.

Note that whereas the **&F0** reset command always restores the factory default profile, the **Z** reset command restores either the factory default or the stored profile, depending on how the **&W** command is set.

Command: **&Cn**
Function: DCD Control
Values: n = 0, 1, or 2
Default: **&C1** (DCD normal)
Description: Controls behavior of the DCD (Data Carrier Detect) signal (pin 8 on the RS232E/V.24 interface). Normally, DCD goes high when the TA establishes a connection and drops when the connection is lost. However, you also can force DCD to remain high at all times or to remain high except for a brief drop following a disconnect.

- **&C0** DCD is forced high at all times
- **&C1** DCD goes from low to high when TA establishes a connection (DCD normal)
- **&C2** DCD drops briefly following disconnect, then goes high again. Register S10 defines how long DCD signal remains low after disconnect

Command: **&Dn**
Function: DTR Control
Values: n = 0, 1, 2, 3, or 4
Default: **&D1** (exits data mode and re-enters AT command mode)
Description: Controls how TA responds to DTR (Data Terminal Ready) signal on pin 20 of RS232E/V.24 interface. A high DTR signal tells the TA that the connected computer is ready to communicate.

- **&D0** TA ignores the DTR signal
- **&D1** When DTR goes low, TA exits data mode and re-enters AT command mode
- **&D2** If DTR goes low, when TA is on-line, the TA hangs up, returns to command mode, and disables autoanswer. If TA is offline, it neither answers nor dials while DTR is low.
- **&D3** When DTR goes low, TA resets the data port and disables autoanswer. If DTR goes low when TA is online, TA hangs up, resets active configuration to the stored configuration, and disables autoanswer.

  **Note:** If the user wants to accept calls while DTR is low, the TA must be configured to ignore DTR. To do this, enter AT&D0<cr>. With this configuration, the TA is able to accept calls while DTR is low. If this configuration setting is not made, the TA rejects incoming calls until DTR is high while the calls comes in.
- **&D4** Ignores DTR when answering a data call. If DTR is low when an incoming data call is present, the TA will answer the call. If DTR goes high during that call, nothing will happen. However, if DTR goes high and then drops for the minimum time specified by S25, then the call will be disconnected just as it would with &D1. &D4 is the same as &D1, except that &D4 can answer a data call without DTR and DTR can remain low for the duration of the call, but if DTR goes high, then &D4 will behave like &D1.

Command: **&En**
Function: Flow Control
Values: n = 3–7, 12, 13
Default: **&E4, &E6, &E13**
Description: Selects method by which the TA controls the flow of data to and from the computer to prevent either device from accepting data faster than it can handle. The TA provides flow control in both directions. When the TA halts data flow, it is called *flow control*; when the computer halts data flow, it is called *pacing*.

- **&E3** Disable flow control by the TA
- **&E4** Hardware flow control. **&E4** causes the TA to use the CTS signal on pin 5 of the RS232E/V.24 interface to regulate flow control. When CTS goes low, data flow from the computer is suspended until CTS goes high again. This method works with pacing, which uses the RTS signal on pin 4. Hardware flow control cannot be enabled unless an error correction protocol is selected.
- **&E5** XON/XOFF flow control. This is an in-band method, in which the XON and XOFF characters (^Q and ^S, respectively) are inserted into the data stream, rather than using separate control lines. When an XOFF character is detected, the data stream is suspended until an XON character is detected. The drawback to this method is that some files may contain these characters, causing the file transfer to be suspended indefinitely.
- **&E6** When XON/XOFF pacing is active, TA responds to and discards the XON/XOFF characters from the computer.
- **&E7** When XON/XOFF pacing is active, the TA responds to the XON/XOFF characters and passes them through the communications link to the remote device, thereby pacing the remote terminal adapter as well.
- **&E12** Disables pacing
- **&E13** Enables pacing

Command: **#Xn**
Function: Send Single/Multiple Xoff Characters
Values: n = 0 or 1
Default: **#X0**
Description: Allows TA to send either a single or multiple Xoff characters to exert flow control to the terminal.

The #X0 command (factory default setting) causes one Xoff to be sent until the MTA128ST-USB's buffer reaches the Xon level. The #X1 command uses an Xoff to be sent for every character received after TA reaches its buffer full level.

- **#X0** One Xoff character sent until buffer reaches the Xon level (default)
- **#X1** Multiple Xoff characters sent for every character received after buffer reaches the full level

Command: **&Fn**
Function: Load Quick Setup Profile
Values: n = 0–4
Default: **&F0**
Description: For quick setup, the TA includes six Quick Setup Profiles, each contains configuration parameters for a specific type of port operation. To load a Quick Setup Profile into active memory, use **&Fn,** where n is the profile number to load. You then can customize the profile and store it using the **&W** command, so it loads automatically on power-up or reset. These profiles are stored in permanent memory and are not user configurable. (Appendix B.)

**&F0** Profile 0 — Modem-like operation (default)
**&F1** Profile 1 — V.110 async operation
**&F2** Profile 2 — V.120 async operation
**&F3** Profile 3 — X.75 async operation
**&F4** Profile 4 — MLPPP async operation

Command: ***&Jn***
Function: Automatic Channel Bundling
Values: n = 0 or 1
Default: n/a
Description: **&J1** causes the TA to dial the number given in the dial string again to set up a bundled PPP connection (also known as MultiLink PPP). Only works with the PPP/ML-PPP protocol (***!Z=9***). **&J0** will not dial the given number again and it will not interfere with the given dial string meaning that if there are two numbers in the dial string (like ***ATD5551000&5553000***) the TA will dial both of those numbers. **&J0** does not disable the dialing of a second number if a second number is given in the dial string.

**n=0** disables automatic channel bundling
**n=1** enables automatic channel bundling

Command: **&Rn**
Function: CTS Control
Values: n = 0, 1, or 2
Default: **&R1** (CTS forced high)
Description: Allows you control the state of the CTS (Clear to Send) signal on the RS232E/V.24 interface. Normally the CTS signal follows the state of the RTS signal when the MTA128ST-USB is online.

**&R0** CTS acts normally; i.e., it follows RTS
**&R1** CTS is forced high, but still provides online flow control
**&R2** CTS is forced high, but it drops on disconnect for the period of time set by S10. CTS still provides flow control when the TA is online.

Command: **&Sn**
Function: DSR Control
Values: n = 0, 1, or 2
Default: **&S0** (DSR high)
Description: Controls state of DSR (Data Set Ready) signal on RS232E/V.24 nterface. A high DSR signal indicates to the computer that TA is ready to transmit data.

**&S0** DSR is always high.
**&S1** DSR acts normally; that is, it follows the state of the CD signal, which goes high when the MTA128ST-USB detects a carrier signal, and goes low when the carrier signal is lost.
**&S2** DSR is always high, except on disconnect, when it drops for the period of time set by S10 and then goes high again.

Command: **&Wn**
Function: Store Active Profile
Values: n = 0 or 1
Default: **&W1** (Use factory default profile)
Description: Stores your active profile, or configuration, in memory, so you won't lose custom settings when you turn off the TA or reset it.

**&W0** Stores all current AT command and S-register values in nonvolatile random access memory (NVRAM) and configures the TA so it reads your custom settings in NVRAM when the TA is turned on or when it is reset with the **Z** command. (The **&F** reset command continues to read factory default settings in ROM.)

**&W1** Erases your custom settings in NVRAM the next time the TA is turned off or reset, causing the TA to read factory default settings in ROM whenever it is turned on or reset.

Command: **&Zn=x**
Function: Store Telephone Number
Values: n = 0–9; x = dial string
Default: n/a
Description: The **&Z=** command lets you store a telephone number in a memory register for faster dialing. To store a number, type **&Z**, the register number (0–9) where you want to store the number, the **=** character, and the dialing string that you want stored; then press ENTER. The dialing string can have up to 25 characters. To read a stored number, type **AT&Zn?** (e.g., **AT&Z4?**) where n is the number of the register you want to read. To display a list of all numbers stored in memory, type **ATL** and press RETURN:

| | |
|---|---|
| 0 | 14082345678 |
| 1 | 16125551212 |
| 2 | 14089876543 |
| 3 | |
| 4 | 6313551 |
| 5 | |
| 6 | 4258513 |
| 7 | |
| 8 | 16126313550 |
| 9 | 12138880123 |

Command: **$Dn**
Function: Persistent DTR Dialing
Values: n = 0, or 1
Default: **$D0** (Disabled)
Description: Enables or disables persistent DTR dialing (PDD). PDD causes the terminal adapter to automatically and continuously redial stored telephone number 0 when the port has no active calls and DTR is high.

**$D0** Disables PDD.

**$D1** Enables PDD.

Command: **$MBn**
Function: V.110 Network Rate
Values: n = 600, 1200, 2400, 4800, 9600, 19200, 38400
Default: $MB38400
Description: If S77=1, then the network rate of the V.110 connection will match that of $MB (S76). If a V.110 call is received and S77=1, then the incoming V.110 network rate must match $MB (S76) or the connection will fail. If S77=2 and a V.110 call is originated, then the network rate will match that of $MB (S76). If S77=2 and a V.110 call is received, then the setting of $MB (S76) will have no effect on the network rate of that call (see S77 for a description for this case). The value of $MB will change if S76 is changed and the value of S76 will change if $MB is changed.

Command: **%En**
Function: Escape Sequence Options
Values: n = 0–5
Default: **%E1** and **%E4**
Description: By default, the TA responds only to the +++ escape method. However, you can use the **%E** command to set the TA to respond only to the <break> method, to respond to either the +++ or the <break> method, or to ignore both methods and not escape.

| | |
|---|---|
| **%E0** | Modem won't escape |
| **%E1** | +++ escape method |
| **%E2** | <break> escape method |
| **%E3** | Both +++ and <break> escape methods |
| **%E4** | Disable OK response to +++ |
| **%E5** | Enable OK response to +++ |
| **%E1 %E5** | Enable +++ method and OK response to +++ |
| **%E3 %E5** | Enable +++ or <break> method and OK response to +++ |

## Data Call Commands

Use these commands to make or configure data calls.

Command: **A**
Function: Answer Call
Values: none
Default: none
Description: Forces TA to answer an incoming call. To make the TA autoanswer, set register **S0** to a value higher than 0.

Command: **D**
Function: Dial
Values: none
Default: none
Description: The **D** command causes the TA to dial a number (e.g., **ATD785-3500 <cr>**).

Command: **DSn**
Function: Dialing a Stored Telephone Number
Values: n = 0–9
Default: n = 0
Description: To dial a stored telephone number, type **&DSn** in terminal mode, where n is the location of the number you want to dial. For example, type **ATDS3 <cr>** dials a telephone stored in memory register 3 location.

Command: **Hn**
Function: Hang Up
Values: 0
Default: n = 0
Description: Forces TA to go off-hook (to take control of the telephone line) or to go on-hook (hang up). Since the TA goes off-hook automatically when it dials, the **H** command is normally used only to hang up. To hang up, first escape to command mode (**+++AT <cr>**), then type **ATH** (or **ATH0**) **<cr>**. You also can include the hang-up command in the escape sequence: **+++ATH <cr>**.

**H** Go on-hook (hang up)

Command: **In**
Function: Display Product Information
Values: n = 0, 1, 2, and 4
Default: none
Description: Displays the following MTA128ST-USB product information.

**I0** Product ID (e.g., 247)
**I1** Firmware version number (e.g. 6.00)
**I2** Model number (e.g., MTA128ST-USB)
**I4** Date and time firmware was made

Command: **O**
Function: Return Online
Values: none
Default: none
Description: The **O** command returns the TA to online mode from online comman mode. When TA makes a data connection, it enters online data mode. TA remains in this mode until it receives an escape sequence or until the call ends. When it detects an escape sequence, the TA enters online command mode, where it can accept AT commands while retaining the online connection. To return TA to online mode from online command mode, enter **ATO** and press ENTER.

Command: **@CONFIG**
Function: Start ConfigMenu
Values: none
Default: none
Description: The **@CONFIG** command starts the TA's internal configuration utility, used to customize the TA's configuration for your application. You must enter the command while in your communication program's terminal mode.

# S-Registers

S-registers are sections of memory in which values are stored that affect how the MTA128ST-USB operates. S-registers are so-called because each has a name that begins with the character S. Use the **S** command to assign a value or to read the current value of an S-register. To assign a value to an S-register, use the command **Sr=n**, where **r** is the register number, and **n** is the value you want to assign, e.g., **S7=45**. To read an S-register value, use the command **Sr?**, where r is the register number, e.g., **ATS7?**.

## S-Register Summary

| S-Register | Function |
|---|---|
| S0 | Rings Until Answer |
| S1 | Ring Count |
| S2 | Escape Character |
| S3 | Carriage Return Character |
| S4 | Line Feed Character |
| S5 | Backspace Character |
| S7 | Wait for Connection (Abort Timer) |
| S8 | Pause Time for Comma |
| S10 | DCD Drop Time |
| S25 | DTR Drop Time |
| S30 | On-line Inactivity Timer |
| S31 | Maximum Redial Timeout Value |
| S32 | Escape Sequence Timeout |
| S34 | Maximum Escape Sequence Length |
| S44 | POTS Port Ring Frequency |
| S45 | Use Dial Tone from Central Office |
| S46 | Pulse-Dial Recognition |
| S49 | POTS Port Dial Tone Gain |
| S50 | Caller Line ID (CLI) |
| S51 | POTS Port Dial Tone Suppression |
| S52 | Auto-Protocol Detection |
| S53 | Maximum Frame Size (X.75) |
| S54 | Force 56 Kbps B-Channel Data Rate |
| S55 | POTS Port Call Control |
| S56 | Calling Party Number IE Settings |
| S57 | Called Party Number IE Settings |
| S58 | Client-Side Authentification Protocol Negotioation |
| S59 | Dynamic Bandwidth Allocation (DBA) Scheme |
| S60 | Bandwidth-on-Demand (BOD) High Threshold |
| S61 | Bandwidth-on-Demand High Throughput Threshold |
| S62 | Bandwidth-on-Demand (BOD) Low Threshold Sampling Period |
| S63 | Bandwidth-on-Demand (BOD) Low Throughput Threshold |
| S64 | Call Bumping (CB) |
| S65 | POTS Call Bump Forwarding Delay |
| S66 | Country Selections for POTS Ring Signal |
| S67 | Single or Dual Cadence Ring Signal |
| S68 | First Active Duration |
| S69 | First Idle Duration |
| S70 | Second Active Duration |
| S71 | Second Idle Duration |
| S73 | MultiLink Endpoint Discriminator Type |
| S75 | Maximum V.110 Buffer Size |
| S76 | V.110 Network rate |
| S77 | V.110 Network Rate Control |

S-Register: **S0**
Function: Number of Rings Until Answer
Unit: 1 ring
Range: 0–255
Default: 1
Description: Sets the number of rings the TA waits for before it answers and begins its connect sequence. **S0=0** turns off the ability to automatically answer a call. **S0=1** causes the TA to automatically answer after 1 ring. If the **S0** value is set too high, the calling device may time out before the TA answers the call. For autoanswer, **S0** must have a nonzero value, DTR must be high (**&D** command), and the TA must be offline.

S-Register: **S1**
Function: Ring Count
Unit: 1 ring
Range: 0–255
Default: 0
Description: Counts the number of rings that have occurred, up to a maximum of 255. It is a read-only register and is seldom used in typical operation. If you set **S1** to a value other than its default value of zero or if the value is increasing with rings, this new value remains stored in **S1** for eight seconds after the last ring is counted, after which time the value reverts to zero.

S-Register: **S2**
Function: Escape Character
Unit: Decimal ASCII code
Range: 0–127
Default: 43 (+)
Description: Specifies the character used by the TA to escape from data mode and return to command mode.

S-Register: **S3**
Function: Carriage Return Character
Unit: Decimal ASCII code
Range: 0–127
Default: 13 (^M)
Description: Specifies the character used by the TA to indicate the end of a command line.

S-Register: **S4**
Function: Line Feed Character
Unit: Decimal ASCII code
Range: 0–127
Default: 10 (^J)
Description: Specifies the character used by the TA to indicate the end of a status message.

S-Register: **S5**
Function: Backspace Character
Unit: Decimal ASCII code
Range: 0–32, 127
Default: 8 (^H)
Description: Specifies the character used by the TA to delete the previous character in the command line.

S-Register: **S7**
Function: Wait for Connection (Abort Timer)
Unit: 1 second
Range: 0–255
Default: 45
Description: Sets the Abort Timer delay time, which is the length of time the TA waits for a connection after dialing. If no connection is established during the specified time, the TA ends the call.

S-Register: **S8**
Function: Pause Time for Comma
Unit: 1 second
Range: n=0-255
Default: 2 (2 seconds)
Description: S8 sets the length of the pause caused by a comma inserted in a dialing command. The default setting is 2 seconds, where each unit is one second. S8 may be set for up to 255 seconds.

S-Register: **S10**
Function: DCD Drop Time
Unit: 50 ms
Range: 0–254, 255
Default: 20
Description: Sets the time after a carrier signal is lost before the TA disconnects. (The **&C2** command must be in effect.) Default setting is one second. Maximum delay is 25.4 seconds (**S10=254**). Set **S10** to 255 to cause the TA not to disconnect with loss of carrier.

S-Register: **S25**
Function: DTR Drop Time
Unit: 100 ms
Range: 0, 1–255
Default: 5
Description: Sets the time that DTR must remain low before TA disconnects. The **S25** unit value for 0 is 50 ms. For values from 1 through 255, the unit value is 100 ms.

S-register: **S30**
Function: On-line Inactivity Timer
Unit: 1 minute
Range: n=0 Does not disconnect
n=1–255
Default: 0 (does not disconnect)
Description: Makes the TA disconnect a data connection if no data is transmitted or received for the specified time. It will NOT cause a POTS call (voice/modem/fax) to disconnect. The timer restarts any time a data character passes through the serial port (either sent or received). Disable the inactivity timer by setting S30=0, which is the factory default setting. S30 currently works for

S-Register: **S44**
Function: POTS Port Ring Frequency
Unit: Decimal ASCII code
Range: 2–4
Default: 2 (25 Hz)
Description: Controls the ring frequency from the POTS port. S44=n where:

- n=2 25 Hz ring frequency
- n=3 20 Hz ring frequency
- n=4 16.67 Hz ring frequency

S-register: **S45**
Function: Use Dial Tone from Central Office
Unit: Decimal ASCII code
Range:

- n=0 No dial tone
- n=1 Use Central Office dial tone
- n=2 TA generates dial tone

Default: 1 (Use Central Office dial tone)
Description: S45 allows the TA either to generate a dial tone on the POTS port, block any dial tone on the POTS port, or allow the dial tone from the central office to pass through to the POTS port (default). Some countries have central offices that send a *loud* dial tone through to the POTS port. This makes DTMF-dialing difficult since DTMF digits have to overcome the loudness of the dial tone (see S49 and S51 for more information).

S-Register: **S46**
Function: Pulse-Dial Recognition
Unit: Decimal ASCII code
Range: 0–3
Default: 0
Description: Controls pulse-dial recognition for New Zealand, Sweden, and the de facto standard for the rest of the world (England, France, India, and USA). S46 selects country where the TA is being used to recognize pulse-dialing. S46=n where:

- n=0 Disable pulse-dialing (default)
- n=1 England, France, India, USA, etc. (# pulses = digit dialed except 0 is 10 pulses)
- n=2 New Zealand (# pulses = 10 digits dialed)
- n=3 Sweden (# pulses = digit dialed + 1)

S-register: **S49**
Function: POTS Port Dial Tone Gain
Unit: Decimal ASCII code
Range: n=0 (Low gain—quiet) thru 10 (high gain—loud)
Default: 0 (Low gain—quiet)
Description: Allows POTS port dial tone gain to be adjusted to an appropriate volume. Must be used in conjunction with S51=1 in order for there to be a noticed change in the dial tone volume. See S51.

S-Register: **S50**
Function: Caller Line ID (CLI)
Unit: Decimal ASCII code
Range: 0 or 1
Default: 1 (enabled)
Description: Sets whether the mechanism for identifying two endpoints of a connection is enabled or disabled. Since RING messages only appear for ISDN data calls, the CLI feature does not define a means of conveying Calling Party information to the terminal for ISDN voice calls. CLI information is included only with the first RING message for a given incoming call and appears as:

RING
FM: 5552000 TO: 5551000

If the Calling Party Number information is not included in the incoming SETUP message, the RING message appears as follows:

RING
TO: 5551000

If the Called Party Number information is not included in the incoming SETUP message, the RING message appears as follows:

RING
FM: 5552000

If neither the Called Party Number nor Calling Party Number is included in the incoming SETUP message, the RING message contains no additional information.

S-Register: **S51**
Function: POTS Port Dial Tone Suppression
Unit: Decimal ASCII code
Range: n = 0, 1
Default: 0
Description: S51 only affects NET3 switch type and voice/modem/fax calls attempted on the POTS port. Some NET3 switches have a *hot* dial tone (dial tone that sounds very loud). If the dial tone is too loud, the TA cannot recognize any or most of the DTMF digits. This is a similar to trying to communicate with another person in a very loud train station—your voice is drowned out by the noise of other people and the trains. By setting S51=1, the TA keeps the receive gain of the POTS port low until a DTMF digit is received. After a DTMF digit is received, the gain is set back to whatever !RXG was set to before the phone, modem, or fax went off-hook (!RXG6 by default). !RXG does not need to be adjusted.

S-Register: **S52**
Function: Auto-Protocol Detection
Unit: Decimal ASCII code
Range: 0 or 1
Default: 1
Description: Enables or disables the mechanism for identifying V.110, V.120, X.75, or MLPPP operation and is applicable for an ISDN data call. The TA determines the protocol used from information conveyed by the SETUP message and activates the indicated protocol. Default setting (1) enables Auto-Protocol Detection function.

S-Register: **S53**
Function: Maximum X.75 Buffer Size
Unit: 1 byte
Range: n=64 - 2048
Default: 2048 (bytes)
Description: S53 allows the maximum buffer size of an X.75 frame to be customized. Typically a smaller frame size is more compatible with software packages on a PC (such as HyperTerminal). Larger frame sizes introduce larger delay which some software cannot deal with appropriately.

S-register: **S54**
Function: Force 56 Kbps B-Channel Data Rate
Unit: Decimal ASCII code
Range: n=56 (Kbps) or 64 (Kbps)
Default: 64 (Kbps)
Description: S54 can be used to force a 56 Kbps B-channel data rate in order to make 56 Kbps data calls.

S-Register: **S55**
Function: POTS Port Call Control
Unit: Decimal ASCII code
Range: 1, 2, 17, 18
Default: 1
Description: Allows you to set the type of information transfer capability for calls placed from the POTS port either by a telephone, modem, or fax. Some Central Office (CO) switches keep track of the type of line each customer has, and if that line is labeled as a data line (modem or fax), it will not accept a speech call originated on that line. However, 3.1 kHz audio information transfer capability is allowed on data lines (modem or fax) by most switches. S55 also lets you define whether a progress indicator information element (which indicates that the origination address of the POTS call is non-ISDN) is sent with the SETUP message for the POTS port call. This may help POTS port calls get through certain CO switches.

**S1** Speech, no progress indicator
**S2** 3.1 kHz Audio, no progress indicator
**S17** Speech, origination address is non-ISDN
**S18** 3.1 kHz Audio, origination address is non-ISDN

S-register: **S56** (applies to NET3 [!C0=2] switch type only)
Function: Calling Party Number IE Settings
Unit: decimal ASCII code
Range: 128 Disable
Type of Number
0 Unknown,
16 International
32 National
48 Network specific
64 Subscriber
96 Abbreviated
Numbering Plan
0 Unknown
1 ISDN/telephony
3 Data

4 Telex
8 National standard
9 Private

Default: 128 (disabled)

Description: Modifies the value of Octet 3 of the Calling Party Number Information Element that is sent within the SETUP message for data and POTS port (voice/modem/fax) calls. To set a specific number type and numbering plan, select an option from the Type of Number section above and add its value to the value of an option in the Numbering Plan section above. For example, a National/ISDN Calling Party Number IE would be S56=33, where 32 (National) + 1 (ISDN/telephony) = 33 (National/ISDN). If there is no Data Directory Number (for data calls) nor Voice Directory Number (for voice/modem/fax calls), no Calling Party Number IE is sent. By default S56=128, which means no Calling Party Number IE is sent.

S-register: **S57** (applies to NET3 [!C0=2] switch type only)

Function: Called Party Number IE Settings

Unit: decimal ASCII code

Range: 128 Disable

Type of Number
0 Unknown,
16 International
32 National
48 Network specific
64 Subscriber
96 Abbreviated

Numbering Plan
0 Unknown
1 ISDN/telephony
3 Data
4 Telex
8 National standard
9 Private

Default: 128 (disabled)

Description: Modifies the value of Octet 3 of the Called Party Number Information Element that is sent within the SETUP message for a data call and within each INFORMATION message that is sent when dialing from the POTS port. To set a specific number type and numbering plan, select an option from the Type of Number section above and add its value to the value of an option in the Numbering Plan section above. For example, a National/ISDN Called Party Number IE would be S57=33, where 32 (National) + 1 (ISDN/telephony) = 33 (National/ISDN). By default S57=128, which means no Called Party Number IE is sent.

S-register: **S58**
Function: Client-side Authentication Protocol Negotiation
Unit: Decimal ASCII code
Range: n=1 PAP
n=2 PAP between TA and PC; CHAP MD5 between TA and server
n=3 ANY authentication protocol
Default: 1 (PAP)
Description: Sets the client-side authentication protocol to be negotiated during the Link Control Protocol (LCP) phase of PPP/MLPPP negotiation. Does not determine which authentication protocol is negotiated if the TA is used on the server side. S58=1 allows only PAP to be negotiated. S58=2 allows PAP between the TA and PC and CHAP MD5 between the TA and server. S58=3 allows any authentication protocol. If the server does not allow PAP, set S58=2 to try CHAP MD5 with the server. If the server doesn't allow CHAP MD5 or the PC doesn't allow PAP, set S58=3 to allow any authentication protocol that the server requests. MultiLink connections are possible if the authentication protocol is PAP (S58=1 or S58=3), CHAP MD5 (S58=2 or S58=3), MS-CHAP (S58=3) and possibly others (S58=3).

S-register: **S59**
Function: Dynamic Bandwidth Allocation (DBA) Scheme
Unit: Decimal ASCII code
Range: n=0 Disable
n=1 MP+
n=2 PPP
Default: 1 (MP+)
Description: Determines whether Dynamic Bandwidth Allocation (DBA) is disabled or enabled by the use of a specific scheme (MP+ or PPP). Setting S59=0 disables DBA and as a result disables the Bandwidth-on-Demand and Call Bumping features. Setting S59=1 (MP+) instructs the TA to negotiate the MP+ option during the PPP LCP phase. If the MP+ DBA scheme is desired, but the server does not support MP+, the TA falls back to the PPP DBA scheme. Due to this fall-back ability, DBA on the client side is always possible. Setting S59=2 to use PPP instructs the TA to use basic PPP requests to perform DBA (the most widely accepted scheme). Basic PPP requests include the LCP Terminate Request command to disconnect a data channel and instruct the TA to add a second channel by dialing the second number given in the dial string (or dialing same number if &J1).
If the TA is used as a host, MP+ must be supported by the client also. The host TA must set S59=1 (MP+). If the TA is used as a host, but either MP+ is not supported by the client or the host did not set S59=1 (MP+), DBA is not possible. For example, if the host sets S59=1, but the client does not support MP+, DBA is not possible. If the host sets S59=2, DBA is not possible. MP+ is required to be negotiated by both the client and host if the host is to perform DBA. The PPP DBA scheme is the most widely accepted DBA scheme. This is why the TA falls back to the PPP scheme if MP+ is not supported, thus allowing DBA to be available at all times (for the client TA). The second data directory number must be set if using the TA as a host with MP+ enabled as the DBA scheme. The TA uses the second data directory number to send to the client as the call-back number to have the client dial to set up the second data channel (call-back number is sent as a part of MP+ protocol). Due to the ability to send the client a call-back number, it is then possible to allow the host to perform DBA as well. Since the PPP DBA scheme cannot instruct the client to call back, we cannot allow the PPP DBA scheme to drop a channel due to analog calls.

***Note:*** *Using the DBA scheme on the host-side requires that you specify a Data Directory Number or MSN. Refer to your TA Owner's Manual for information on how to specify a Data Directory Number or MSN.*

S-register: **S60**
Function: Bandwidth-on-Demand (BOD) High Threshold Sampling Period
Unit: Seconds
Range: n=0 (BOD completely disabled)
n=1 1–255
Default: 10 (10 seconds)
Description: Sets the Bandwidth-on-Demand High Threshold Sampling Period. Refer to Bandwidth-on-Demand description and how the High Threshold Sampling Period (S60) and High Throughput Threshold (S61) are used to determine when a second channel should be added. With Dynamic Bandwidth Allocation enabled and BOD enabled, the client TA always has the ability to utilize BOD. The host TA, however, only has the ability to utilize BOD if MP+ (S59=1) was negotiated successfully by both the client and the host. A short sampling period causes the TA to respond to an increase in the throughput sooner than a long sampling period. By default, the average throughput is determined over 10 seconds of time.

S-register: **S61**
Function: Bandwidth-on-Demand High Throughput Threshold
Unit: Kbps
Range: n=0–64 (Kbps)
Default: 52 (52 Kbps)
Description: Sets the Bandwidth-on-Demand High Throughput Threshold, which determines whether a second channel should be added due to high throughput. Refer to the Bandwidth-on-Demand description and how High Throughput Threshold (S61) and High Threshold Sampling Period (S60) determine when a second channel should be added. By default, the average throughput during the High Threshold Sampling Period (S60) must exceed 52 Kbps.

S-register: **S62**
Function: Bandwidth-on-Demand (BOD) Low Threshold Sampling Period
Unit: Seconds
Range: n=0 Second channel will not disconnect
n=1–255
Default: 10 (10 seconds)
Description: Sets the BOD Low Threshold Sampling Period. Refer to BOD description and how the Low Threshold Sampling Period (S62) and Low Throughput Threshold (S63) determine when the second channel should be disconnected. Setting S62=0 causes the TA to not disconnect second channel when it is added unless Call Bumping is enabled and an analog call bumps the data call on the second channel. Setting S62 to a value other than 0 causes the TA to take an average of throughput. A short sampling period causes the TA to respond to a decrease in the throughput sooner than a long sampling period. By default, average throughput is determined over 10 seconds of time.

S-register: **S63**
Function: Bandwidth-on-Demand Low Throughput Threshold
Unit: Kbps
Range: n=0–64 (Kbps)
Default: 26 (26 Kbps)
Description: Sets BOD Low Throughput Threshold, which determines whether second channel should be disconnected due to low throughput. Refer to the BOD description and how the Low Throughput Threshold (S63) and Low Threshold Sampling Period (S62) determine when second channel should be disconnected. By default, the average throughput during the Low Threshold Sampling Period (S62) must be equal to or less than 26 Kbps.

S-register: **S64**
Function: Call Bumping (CB)
Unit: Decimal ASCII code
Range: n=0 Disable
n=1 Enable
Default: 1 (Enable)
Description: Enables the Call Bumping feature of Dynamic Bandwidth Allocation. With Call Bumping disabled, incoming and outgoing calls are not possible if both B-channels are already in use. With Call Bumping enabled, incoming and outgoing analog calls through the POTS port are possible even if both B-channels are in use. If the TA is acting as a host device, Call Bumping is available to the host TA only if MP+ (S59=1) was negotiated by both the client and the host. Also, Call Bumping is not available to the host TA if the Dynamic Bandwidth Allocation scheme is MP+ (S59=1) and MP+ negotiation fails. If MP+ negotiation was successful (meaning both client and host support MP+), Call Bumping is available to the host TA. By default, Call Bumping is enabled.

***Note:*** *If using the TA as a host for MultiLink PPP calls with the MP+ Dynamic Bandwidth Allocation scheme (S59=1), Data DN/MSN 2 must be entered.*

S-register: **S65**
Function: POTS Call Bump Forwarding Delay
Unit: 5 ms
Range: n=0-255 (0 ms to 1275 ms)
Default: 20 (100 ms delay)
Description: Allows the forwarding delay time to be adjusted. Some central office switches are not able to accept another call immediately after tearing down a call (meaning the TA is able to tear down a call and initiate another call much faster than the central office). If the central office switch is too slow, then a Call Bump (due to an incoming or outgoing analog call) will not be recognized and the analog device will not ring (if incoming) or will not give a dial tone (if outgoing). A delay of 100 ms is the default, which should allow enough time for the central office switch to prepare for new calls.

S-register: **S66**
Function: Country Selections for POTS Ring Signal
Unit: Decimal ASCII code
Range: n=0–27

| | |
|---|---|
| 0 | Default |
| 1 | Custom single |
| 2 | Custom dual |
| 3 | Austria |
| 4 | Belgium |
| 5 | Cyprus |
| 6 | Denmark |
| 7 | Finland |
| 8 | France |
| 9 | Germany 1 |
| 10 | Germany 2 |
| 11 | Greece |
| 12 | Iceland |
| 13 | Ireland |
| 14 | Italy |
| 15 | Luxembourg 1 |
| 16 | Luxembourg 2 |
| 17 | Malta |
| 18 | Netherlands |
| 19 | Norway |
| 20 | Portugal |
| 21 | Spain |
| 22 | Sweden |
| 23 | Switzerland 1 |
| 24 | Switzerland 2 |
| 25 | United Kingdom 1 |
| 26 | United Kingdom 2 |
| 27 | United States |

Default: 0 (25 Hz, single ring, 2 sec. on, 4 sec. off)
Description: Sets the frequencies and cadences used when ringing the device attached to the POTS port (phone, modem, fax). Select the appropriate country to use the frequencies and cadences specified according to ETS 300 001 (Chapter 1:1992, p. 56). The Austria and France settings default the frequency to 25 Hz since the TA doesn't support a 50 Hz nominal frequency. A number 1 or 2 next to a country name indicates the availability of either alternate nominal frequencies or alternate cadences. You also can configure frequencies and cadences by using @CONFIG menu (selection #6—POTS Port Configuration) and/or with S-registers S44, S67, S68, S69, S70, and S71. Save configurations with the &W or &W0 command.

S-register: **S67**
Function: Single or Dual Cadence Ring Signal
Unit: Decimal ASCII code
Range: 0 (Single), 1 (Dual)
Default: 0 (Single-cadence ring signal)
Description: Sets the POTS port ring signal for single or dual cadence. Examples of a dual cadence include Ireland (S66=13), United Kingdom 1 (S66=25), and United Kingdom 2 (S66=26).

S-register: **S68**
Function: First Active Duration
Unit: 1 ms
Range: 5–9995
Default: 2000 ms
Description: Sets the duration of the first active period of the ring signal. Any value given to this S-register is rounded down to the nearest 5 ms. For example, S68=1234 sets S68 to 1230 ms (1.23 seconds).

S-register: **S69**
Function: First Idle Duration
Unit: 1 ms
Range: 5–9995
Default: 4000 ms
Description: Sets the duration of the first idle period of the ring signal. Any value given to this S-register is rounded down to the nearest 5 ms. For example, S69=231 sets S69 to 230 ms (0.23 seconds).

S-register: **S70**
Function: Second Active Duration
Unit: 1 ms
Range: 5–9995
Default: 400 ms
Description: Sets the duration of the second active period of the ring signal. Any value given to this S-register is rounded down to the nearest 5 ms. For example, S70=453 sets S70 to 450 ms (0.45 seconds).

S-register: **S71**
Function: Second Idle Duration
Unit: 1 ms
Range: 5–9995
Default: 2000 ms
Description: Sets the duration of the second idle period of the ring signal (usually the longest duration of a dual-cadence ring signal). Any value given to this S-register is rounded down to the nearest 5 ms. For example, S71=3456 sets S71 to 3455 ms (3.455 seconds).

S-Register: **S73**
Function: MultiLink Endpoint Discriminator Type
Unit: decimal ASCII code
Range: n=0—Null Class,
n=1—Locally Assigned Address,
n=2—IP Address,
n=3—IEEE 802.1 Globally Assigned MAC Address,
n=4—PPP Magic-Number Block,
n=5—Public Switched Network Directory Number
Default: 4 (PPP Magic-Number Block)
Description: This S-register allows the MultiLink PPP Endpoint Discriminator type to be set. The Endpoint Discriminator is used to help determine if a channel is to be bundled with any other channels (forming a MultiLink Group or Bundle) or if it is a new bundle. Currently, the Null Class (S73=0), PPP Magic-Number Block (S73=4), and Public Switched Network Directory Number (S73=5) are

complete. The PPP Magic-Number Block contains 5 Magic-Numbers in this implementation and is the default type. The Public Switched Network Directory Number option uses Data Directory Number 1 as the Endpoint Discriminator (if it is blank, then Endpoint Discriminator is blank). The Locally Assigned Address (S73=1), IP Address (S73=2), and IEEE 802.1 Globally Assigned MAC Address (S73=3) options currently generate a random value similar to the PPP Magic-Number Block, except that the length of the Endpoint Discriminator follows according to the specifications for the respective type. Refer to RFC 1990 for more information about the MultiLink Endpoint Discriminator option and its types.

S-register: **S75**
Function: Maximum V.110 Buffer Size
Unit: 1 byte
Range: n=0 (256 bytes),
n=64-255
Default: 0 (256 bytes)
Description: S75 allows the maximum V.110 buffer size to be customized. An adjustable packet size can provide higher compatibility with devices that cannot handle a large delay. Reducing the V.110 buffer size reduces delay.

S-register: **S76**
Function: V.110 Network Rate
Unit: decimal ASCII code
Range: n=1—-—600 bps,
n=2——1200 bps,
n=3——2400 bps,
n=4——4800 bps,
n=5——9600 bps,
n=6—19200 bps,
n=7—38400 bps,
Default: 7 (38400 bps)
Description: If S77=1, then the network rate of the V.110 connection will match that of S76 ($MB). If a V.110 call is received and S77=1, then the incoming V.110 network rate must match S76 ($MB) or the connection will fail. If S77=2 and a V.110 call is originated, then the network rate will match that of S76 ($MB). If S77=2 and a V.110 call is received, then the setting of S76 ($MB) will have no effect on the network rate of that call (see S77 for a description for this case). The value of S76 will change if $MB is changed and the value of $MB will change if S76 is changed.

S-register: **S77**
Function: V.110 Network Rate Control
Unit: decimal ASCII code
Range: n=1—use $MB (S76),
n=2—use $MB (S76) or Auto Sync on Answer
Default: 2 (use $MB(S76) or Auto Sync on Answer)
Description: The Network Rate for V.110 will be determined by S76 ($MB). If S77=1, then the network rate will be set to that of S76 ($MB) and if the network does not match that of the peer device, then the connection will fail. Properties of S77=1 apply to both received and originated calls. If the TA will be answering a V.110 call, then it can be set to auto-synchronize (S77=2) on the incoming V.110 network rate.

Auto-synchronizing allows the TA to adapt to the client's network rate without any need for the host to have its network rate predetermined. If S77=2 and a V.110 call is originated, then the network rate will be that of S76 ($MB).

S-Register: **S80**
Function: Persistent DTR Dialing Delay
Unit: 1 second
Range: n=1-255 (1-255 seconds)
Default: 5 (5 seconds)
Description: Once DTR is detected as present (active high) and other conditions required for the TA to dial are met, a delay of S80 seconds will occur before stored number 0 is dialed. Some conditions include the TA not being in the @CONFIG menu, not having a data call present at the time, and Persistent DTR Dialing must be enabled. By default the TA will delay for 5 seconds before dialing when all conditions are satisfied.

# Result Codes

When the MTA128ST-USB (TA) receives an AT command from the computer or terminal, it attempts to execute the command, then sends a status message to the computer or terminal that reports the result of the command. The TA provides you with several of these response messages, or *result codes,* which can be displayed on your monitor or intercepted and used by your communications software. Using the ***V*** command, you can select whether the result codes are *terse* (numbers) or *verbose* (words).

The TA's result codes are listed below. Note that the speed of an ISDN channel is always either 56 Kbps or 64 Kbps. *Connect* messages indicate the speed of the connection between the TA and your computer or terminal.

| TERSE | VERBOSE | DEFINITION |
|---|---|---|
| 0 | OK | TA executed the command without error |
| 1 | Connect | TA established an ISDN connection |
| 2 | Ring | TA detected a ring caused by incoming call |
| 3 | No carrier | TA did not detect carrier within time allotted by S-Register S7 |
| 4 | Error | Error in the AT command |
| 5 | Connect 1200 | TA connected at 1200 bps |
| 6 | No dial tone | TA has a poor connection to ISDN network |
| 7 | Busy | TA detected a busy signal |
| 9 | Connect 600 | TA connected at 600 bps |
| 10 | Connect 2400 | TA connected at 2400 bps |
| 11 | Connect 4800 | TA connected at 4800 bps |
| 12 | Connect 9600 | TA connected at 9600 bps |
| 14 | Connect 19200 | TA connected at 19200 bps |
| 28 | Connect 38400 | TA connected at 38400 bps |
| 56 | Connect 56000 | TA connected at 56000 bps |
| 64 | Connect 64000 | TA connected at 64000 bps |
| P | /PPP | TA using Point-to-Point protocol |
| T | /V.110 | TA using V.110 rate adaption protocol |
| V | /V.120 | TA using V.120 rate adaption protocol |
| X | /X.75 | TA using X.75 rate adaption protocol |

# Using AT Commands to Operate the MTA128ST-USB

You can configure and operate the MTA128ST-USB entirely with AT commands if you like. But remember, you can issue AT commands only from a terminal or from a computer running a communications program in terminal mode. This section describes how to use AT commands for basic operations, such as calling, answering a call, and hanging up.

## Modes of Operation

The MTA128ST-USB has three modes of operation. They are:

- *Offline Command Mode*—The MTA128ST-USB communicates with the terminal or computer and responds to AT commands. There is no data communications link with a remote device.
- *Data Mode*—The MTA128ST-USB enters data mode when it makes a successful data communications link with a remote device. In data mode, the TA can send and receive data, but it does not respond to AT commands. Instead it treats them as data and transmits them to the remote device.
- *Online Command Mode*—The MTA128ST-USB responds to AT commands while maintaining a data communications link; however, transmission of data is suspended. To enter online command mode from data mode, type the escape sequence **+++AT<cr>**. To return to data mode from online command mode, type **ATO<cr>**.

# Making a Call

Before you can place a data call, configure the MTA128ST-USB for the local switch type, serial port speed, and the data type of the ISDN device you want to call. See Chapter 3, Configuration Utilities.

## Dialing

To dial a number using AT commands, you must first start a data communications program. In the program's terminal mode, type **ATDxxxxxxx<cr>,** where xxxxxxx is the telephone number you want to dial, and <CR> is the carriage return character that is sent when you press the ENTER key, e.g., **ATD7853500<cr>**. The dial string can contain up to 80 characters.

To place an ML-PPP call, use an ampersand character (*&*) to join two telephone numbers, e.g., **ATD7853500&7853502<cr>**. The telephone numbers can be the same or different. Using this method, two B-channels are activated to transmit data at an aggregate speed of 128 Kbps.

To make it easier to read the dial string, you can use hyphens, spaces or parentheses. These characters are ignored by the MTA128ST-USB. For example, the MTA128ST-USB would read the following dial strings the same way:

***ATD16127853500* <cr>**
***ATD 1-612-785-3500* <cr>**
***ATD 1 (612) 785-3500* <cr>**

## Channel Bundling Flag Dialing

The command AT&Jn is used to indicate whether outgoing calls should be made on two B-channels by default. The command AT&J1&W0<cr>, configures the TA to place a call, dialing on two B-channels by default. If no second number is given in the dial string, that single number is dialed twice. This compensates for the interworking issues with Windows 95. On the other hand, if the user explicitly indicates two numbers in the dial string, then two numbers are dialed (e.g., **ATD7853500&7853502<cr>**). The command AT&J0&W0<cr>, disables automatic call bundling. Note other valid characters joining two telephone numbers include a plus sign (**+**), and an exclamation mark (**!**).

---

***Note:*** *In Windows 98/95, if the* Use Country Code and Area Code *box is checked in the* ***Properties*** *window for dial-up connection, the bundling modifier (i.e., &, + or !) is removed from the dialing string when the user attempts to make a connection. The solution is to not check the* Use Country Code and Area Code *box or to simply add the bundling dial modifier to the phone number at the time of connection.*

---

## Canceling a Call

To cancel a call before the TA makes a connection, press any key.

## Storing a Telephone Number

To store a telephone number, type ***&Zn=x*** in terminal mode, where *n* is the number of the memory register in which the number is to be stored, and *x* is the dial command string that you want to store. For example, type **AT&Z9=612-785-3500 <cr>** to store the number 612-785-3500 in memory register 9.

## Dialing a Stored Telephone Number

To dial a stored telephone number, type ***DSn*** in terminal mode, where *n* is the location of the number you wish to dial. For example, type **ATDS3 <cr>** dials a telephone stored in memory register 3 location.

## Displaying a Stored Number

To display a stored telephone number, type ***&Zn?*** in terminal mode, where *n* is the memory register in which the number is stored. For example, type **AT&Z5? <cr>** to display the telephone number in memory register 5. To list all ten telephone numbers stored in memory, type **ATL <cr>**.

# Answering a Call

You can answer incoming calls to the TA either manually or automatically. When the TA detects an incoming call, it sends a *RING* result code to the computer or terminal after each ring. If autoanswer is enabled, the TA automatically answers the call. You can manually answer the call with the ***A*** command. Both methods are described below.

## Answering Manually

If your communication program is in terminal mode when the *RING* result code appears on your monitor, you can manually answer the call by typing ***ATA*** **<cr>**.

## Answering Automatically

To cause the TA to automatically answer a call:

1. Enable autoanswer by setting register ***S0*** to the ring on which you want the TA to answer (e.g., in terminal mode, type ***S0=4*** to make the TA answer on the fourth ring). You also can use either of the configuration utilities to the turn on autoanswer and set the number of rings.
2. Make sure that the TA is offline.

The TA answers the call after the number of rings specified by ***S0***. To disable autoanswer, use a configuration utility or the command ***S0=0***.

---

***Note:*** *If the user wants to accept calls while DTR is low, the TA must be configured to ignore DTR. To do this, enter AT&D0<cr>. With this configuration, the TA can accept calls while DTR is low. If this configuration setting is not made, the TA rejects incoming calls until DTR is high while calls comes in.*

---

# Hanging Up

To hang up a call, escape to online command mode (**+++*AT*<cr>**), then enter the ***H*** command (***ATH*<cr>**). The escape sequence and hang up command can be combined into one command string: **+++*ATH*<cr>**.

MultiModemISDN™

# Chapter 5 - Troubleshooting

MultiTech® Systems

# Introduction

This chapter describes basic problems you may run into with your MTA128ST-USB and how to solve them. Your MTA128ST-USB was thoroughly tested at the factory before it was shipped. If you are unable to make a successful connection, or if you experience data loss during your connection, it is possible that the MTA128ST-USB is defective. However, it is more likely that the source of your problem lies elsewhere. Problems you may encounter include the following:

- None of the LEDs light when the MTA128ST-USB is on.
- The MTA128ST-USB does not respond to commands.
- The MTA128ST-USB dials but cannot make a connection.
- You can place data calls but not voice calls, or vice versa.
- You cannot place two simultaneous data calls.
- The MTA128ST-USB disconnects while online.
- The MTA128ST-USB cannot connect when answering.
- File transfer appears slower than it should be.
- Data is being lost.
- There are garbage characters on the monitor.

If you experience problems, please check the following possibilities before calling Tech Support (see Chapter 6).

### *None of the LEDs light when the MTA128ST-USB is on*

When you turn on the MTA128ST-USB, the LED indicators on the front panel should flash briefly as the unit runs a self-test. If the LEDs remain off, the unit probably is not receiving power.

- Make sure the MTA128ST-USB's power switch is on, especially if you normally turn on the unit by turning on a power strip.
- If the power supply is plugged into a power strip, make sure the power strip is plugged in and its power switch is on.
- Make sure the power supply module is firmly connected to the MTA128ST-USB and to the wall outlet or power strip.
- If the power strip is on and the MTA128ST-USB is switched on, try moving the unit's power supply to another outlet on the power strip.
- Test that the outlet is live by plugging a lamp into it.
- The MTA128ST-USB or power supply may be defective. If you have another Multi-Tech MTA128ST-USB, try swapping units. If the problem goes away, the first unit or power supply may be defective. Call Tech Support for assistance.

***Caution:*** *Do not under any circumstances replace the power supply module with one designed for another product, as it may damage the MTA128ST-USB and void your warranty.*

### *The MTA128ST-USB does not respond to commands*

- Make sure the MTA128ST-USB is plugged in and turned on. (See *None of the LEDs Light When the MTA128ST-USB Is On.*)
- Try resetting your MTA128ST-USB by turning it off and on.
- Make sure you are issuing the MTA128ST-USB commands from the data communications software, either automatically, or manually in terminal mode. (You cannot send commands to the MTA128ST-USB from the DOS prompt.)
- Make sure you are in terminal mode in your data communications program. Then type **AT** and press ENTER. If you get an *OK* response, your connections are good and the problem may be in your phonebook entry or session settings.
- If you don't get an *OK*, the problem may still be in the communications software. Make sure you have done whatever is necessary in your software to make a port connection. Not all communications programs connect automatically to the COM port. Some connect when the software loads and remain connected until the program ends. Others, like MultiExpress Terminal, can disconnect without ending the program (make sure the Connect icon is plugged in). MultiExpress Terminal also allows multiple terminals to be open, but only one can access the MTA128ST-USB at a time. If MultiExpress Terminal reports that it cannot make a connection, yet the MTA128ST-USB's *TR* indicator is on, click on the Window menu to see if more than one terminal is open. The MTA128ST-USB's *TR* indicator shows that the software has made a connection with the unit through the COM port.
- Your communications software settings may not match the physical port the MTA128ST-USB is connected to. The USB cable may be plugged into the wrong connector—check your computer documentation to make sure. Or you may have selected a COM port in your software other than the one the MTA128ST-USB is physically connected to—compare the settings in your software to the physical connection.
- If the MTA128ST-USB is on, the cable is plugged into the correct port, the communications software is configured correctly, and you still don't get an *OK*, the fault may be in the USB cable. Make sure it is firmly connected at both ends.
- Is this the first time you have used the cable? If so, check the cable description on the packaging to make sure the cable is correct for your computer.
- Peripheral expansion cards, such as bus mouse and sound cards, may include a USB port preconfigured as COM1 or COM2. The extra USB port, or the card itself, may use the same COM port, memory address, or interrupt request (IRQ) as your communications port. Be sure to disable any unused ports.

  If you use Windows 98/95, right-click on *My Computer*, select *Properties* from the menu, click on the *Device Manager* tab, double-click on *Ports*, then double-click on the *Communications Port* your MTA128ST-USB is connected to. In the port's Properties sheet, click on the *Resources* tab to see the port's Input/Output range and Interrupt Request. If another device is using the same address range or IRQ, it will appear in the Conflicting Device List. Uncheck Use Automatic Settings to change the port's settings so they do not conflict with the other device, or select the port the conflicting device is on and change it instead. If you need to open your computer to change switches or jumpers on the conflicting device, refer to the device's documentation.
- The USB port may be defective. If you have another USB port, install the MTA128ST-USB on it, change the COM port setting in your software, and try again.

- The MTA128ST-USB may be defective. If you have another Multi-Tech MTA128ST-USB, try swapping units. If the problem goes away, the first MTA128ST-USB is possibly defective. Call Tech Support for assistance (see Chapter 6).

### *The MTA128ST-USB dials but cannot make a connection*

There may be several reasons the MTA128ST-USB fails to make a connection. Possibilities include

- Lack of a proper physical connection to the communication line.
- A busy signal.
- A wrong number.
- No terminal adapter at the other end.
- A faulty communications device, computer, or software at the other end.
- Incompatibility between communications devices.
- An improperly configured MTA128ST-USB.

Narrow the list of possibilities by using extended result codes. To enable them, enter **ATV1X2** and press ENTER while in terminal mode or include **V1X2** in the MTA128ST-USB's initialization string (**V1X2** is enabled by default). When you dial again, the MTA128ST-USB reports the call's progress.

- If the MTA128ST-USB reports *NO DIALTONE*, check that the ISDN S/T cable is securely connected to both the unit's ISDN jack (not the AUX jack) and the ISDN network terminator or wall jack. If the cable looks secure, try replacing it. If that doesn't work, the problem may be in your building's telephone installation. Make sure ISDN cables on all devices are wired straight-through (pin 1 to pin 1, pin 2 to pin 2, etc.) and do not have reversed pairs. The cable must have at least the middle four pins (pins 2, 3, 4, and 5) connected. A reversed pair on the U (phone company) side is not important, but a reversed pair on the S/T (your) side can create problems if you have more than one device, since multiple devices attached to the S/T interface must all have the same polarity.
- If the MTA128ST-USB reports *BUSY*, the other number may be busy, in which case you should try again later.
- If the MTA128ST-USB reports *NO CARRIER*, no connection was made. You might have dialed the correct number but the other computer or software was turned off or faulty. Check the number and try again, or try calling another system to make sure your unit is working. Also, check that you accurately configured the TA with the correct switch type, TEIs, data protocols, and other parameters needed for a successful call (see Chapter 3).

### *You can place data calls but not voice calls or vice versa*

- You might not have ordered both voice and data service from your ISDN provider. Check your contract or latest statement of service from your ISDN provider.
- Your ISDN provider may have programmed the switch incorrectly. Call the provider.

### *You cannot place two simultaneous data calls*

- You may not have ordered an ISDN line configuration that supports two simultaneous calls. Check your contract or latest statement of service from your ISDN provider. Also, your ISDN provider may have programmed the switch incorrectly. Call the provider.
- You may have misconfigured your MTA128ST-USB to dial two simultaneous data calls. The command AT&J1&W0<cr> is used to indicate whether outgoing calls should be made on two B-channels by default.
- You may be using the wrong *bundling* dial modifier (e.g., ATD7853500**&**7853502<cr>). The ampersand in this command string is correct. Other valid characters joining two telephone numbers include a plus sign (**+**) and an exclamation mark (**!**).

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***Note:*** *In Windows 98/95, if the* Use Country Code and Area Code *box is checked in the* ***Properties*** *window for dial-up connection, the bundling modifier (i.e., &, + or !) is removed from the dialing string when the user attempts to make a connection. The solution is not to check the* Use Country Code and Area Code *box or to simply add the bundling dial modifier to the phone number at the time of connection.*

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### *The MTA128ST-USB disconnects while online*

- Check for loose connections between the MTA128ST-USB and the computer, the ISDN jack, and AC power.
- The problem may have originated at the other end of the line. Try again.
- If you were online with a BBS or online service, it may have hung up on you because of lack of activity on your part or because you exceeded your time limit for the day. Try again.

### *The MTA128ST-USB cannot connect when answering*

- Autoanswer may be disabled. Turn on autoanswer in your data communications program or send the command **ATS0=1** to your MTA128ST-USB in terminal mode.

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***Note:*** *If the user wishes to accept calls while DTR is low, the MTA128ST-USB must be configured to ignore DTR. This is accomplished by entering AT&D0<cr>. With this configuration, the MTA128ST-USB is able to accept calls while DTR is low. If this configuration setting is not made, the TA rejects incoming calls until DTR is high while the calls comes in.*

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### *File transfer appears slower than it should be*

- If you have several active USB devices on the same USB link, try deactivating one device at a time to see of the transfer rate increases. USB devices on the same USB link share the same bandwidth of the USB link. There may be several devices using a large amount of bandwidth (such as a USB removable, media disk drive) leaving a small amount of bandwidth for the MTA128ST-USB.

### *Data is being lost*

- USB cable is not plugged in.
- Make sure the flow control method you selected in software matches the method selected in the MTA128ST-USB.

### *Making a V.120 call, caller gets a NO CARRIER message after dialing the number*

Some switches don't support ISDN SETUP messages that contain a LLC (low layer compatibility) element. When these switches receive an LLC in the SETUP, they immediately reject the call and a NO CARRIER message displays. Disable LLC for V.120 calls by issuing the command AT!D0=0. To enable LLC for V.120 calls, issue the command AT!D0=1.

### *Making a V.110 call, caller gets a NO CARRIER message after dialing the number*

Some switches don't support extended BC (bearer capability) information in the ISDN SETUP message, such as the one normally sent by V.110 data protocol. When these switches receive a BC with extended capability information in the SETUP, they immediately reject the call and a NO CARRIER message displays. Disable sending extended BC information for V.110 calls by issuing the command AT!D1=0. To enable sending extended BC information for V.110 calls, issue the command AT!D1=1 (the default setting).

When using X.75 data protocol to transfer data via the Zmodem, the Zmodem displays Intermittent *bad packet* errors and data throughput drops.

This occurs in cases when the X.75 packet size is greater than 1024 bytes and the terminal adapter sending the file has a fast  baud rate (e.g., 115200 bps) or its a USB TA, and the terminal adapter receiving the file has a slow baud rate (e.g., 19200 bps). To reduce or possibly eliminate this, reduce the X.75 packet size (S53) to a value less than or equal to 1024 bytes (e.g., ATS53=512). However, if you set the receiving terminal adapter's  baud rate nearly equal to or greater than the baud rate of the sending terminal adapter, then the packet size can be greater than 1024, and Zmodem transfers the data without *bad packet* errors.

### *The MTA128ST-USB won't accept V.120 calls from a 3Com Impact IQ terminal adapter. The Impact IQ displays a connected status, but the MTA128ST-USB does not.*

The MTA128ST-USB is looking for a SABME command from the Impact IQ to finish establishing the V.120 connection. However, the Impact IQ won't send a SABME until it has data to send. Have the Impact IQ send a character by pressing any key (such as the space bar) on the terminal attached to the Impact IQ. The MTA128ST-USB responds with a CONNECT message and displays the key you pressed (e.g., a space).

### *MTA128ST-USB receives garbage characters when connected to a 3Com Impact IQ terminal adapter*

Most likely, the Impact IQ has compression turned on. The compression used by the Impact IQ is incompatible with the compression used by the MTA128ST-USB. Disconnect the data connection and give the Impact IQ the command AT%CO and then establish the data connection again. The garbage characters should disappear.

### *MTA128ST-USB receives garbage characters after receiving several good characters when connected to a 3Com Sonix adapter*

Most likely, the Sonix has compression turned on. The compression used by the Sonix is incompatible with the compression used by the MTA128ST-USB. Disconnect the data connection and give the Sonix the command AT”HO (that’s a double quote) and then establish the data connection again. The garbage characters should disappear.

### *Each time a 3Com Sonix terminal adapter originates a V.120 call, the MTA128ST-USB answers the call as a V.110 call*

The Sonix sends V.110 information in the SETUP message to the network. Since the MTA128ST-USB’s default is with Auto Protocol Detection enabled (ATS52=1), it looks at SETUP information from the Sonix and determines erroneously that it is a V.110 call. Disable Auto Protocol Detection in the MTA128ST-USB with the command ATS52=0 and try the connection again.

### *MTA128ST-USB won’t connect to an ELSA terminal adapter with the V.120 data protocol*

Most likely, the ELSA terminal adapter has compression turned on. The compression used by the ELSA terminal adapter is incompatible with compression used by the MTA128ST-USB. Give the ELSA the command AT%CO to disable compression and try again.

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# Chapter 6 - Warranty, Service, and Technical Support

MultiTech® Systems

# Introduction

This chapter begins your MTA128ST-USB's five-year warranty. If you have questions or problems with your unit carefully read the next section, *Technical Support*. It includes the technical support telephone numbers and information on how to send in your terminal adapter should you require service. The final sections explain how to get information and technical support from our BBS, how to upgrade the MTA128ST-USB via flash PROM, and information on the CompuServe/Internet forums.

# Limited Warranty

Multi-Tech Systems, Inc. (*MTS*) warrants that its products will be free from defects in material or workmanship for a period of five years from the date of purchase, or if proof of purchase is not provided, five years from date of shipment. MTS MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by the customer or any party without MTS's written authorization, or used in any manner inconsistent with MTS's instructions.

MTS's entire obligation under this warranty shall be limited (at MTS's option) to repair or replacement of any products which prove to be defective within the warranty period, or, at MTS's option, issuance of a refund of the purchase price. Defective products must be returned by Customer to MTS's factory transportation prepaid.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PURCHASE PRICE FOR DEFECTIVE PRODUCTS.

## On-line Warranty Registration

To register your Multi-Tech product on-line, click this link:

http://www.multitech.com/register

# Technical Support

Multi-Tech has an excellent staff of technical support personnel available to help you get the most out of your Multi-Tech product. If you have any questions about the operation of this unit, call Technical Support at (612) 717-5863.

## Service

If your tech support specialist decides service is required, send the MTA128ST-USB (freight prepaid) to our factory. Return shipping charges are paid by Multi-Tech Systems (within North America).

Include the following with your MTA128ST-USB:

- a description of the problem.
- return billing and return shipping addresses.
- contact name and phone number.
- check or purchase order number for payment if the MTA128ST-USB is out of warranty. (The standard repair charge is $95. This price is valid at the time of this publication but could change in the future. Check with your technical support specialist.)
- if possible, note the name of the technical support specialist with whom you spoke.

If you need to inquire about the status of the returned product, be prepared to provide the **serial number** of the product sent.

Send the MTA128ST-USB to:

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, Minnesota 55112
ATTN: Service or Repairs

# The Multi-Tech BBS

Multi-Tech maintains a bulletin board system (BBS) for its customers. Information available from the BBS includes new product information, product upgrade data, and problem-solving tips. There is also a message service that lets you request additional information. The phone number for the Multi-Tech BBS is (612) 785-3702.

You can access the BBS with any asynchronous modem operating at 1200 bps to 33,600 bps at a setting of 8 bits, no parity, and 1 stop bit (8-N-1).

## Logging on to the Multi-Tech BBS

To log on to the Multi-Tech BBS, perform the following steps:

1. Set your communications program to **8-N-1**.
2. Dial our BBS at +(612) 785-3702.
3. At the prompts, type your first name, last name, and password; then press RETURN. If you are a first time caller, the BBS will ask if your name is spelled correctly. If you answer yes, a questionnaire will appear. You must complete the questionnaire to use the BBS on your first call.
4. Press RETURN until Main Menu appears. From the Main Menu you have access to three areas: Files Menu, Message Menu, and Bulletins. For help on menu commands, type **?**.

## Downloading a File

If you know the file name

1. From the Main Menu, enter **F** to access the Files Menu. Then enter **D**.
2. Enter the name of the file you want to download from the BBS.
3. If a password is required, enter the password.
4. Answer **Y** or **N** to the automatic logoff question.
5. Select a file transfer protocol by entering the indicated letter, such as **Z** for Zmodem (the recommended protocol).
6. If you select Zmodem, the transfer begins automatically. If you select another protocol, you may have to initiate the transfer yourself. (In most datacomm programs, the PAGE DOWN key initiates the download.)
7. When the download is complete, press ENTER to return to the File Menu.
8. To exit the BBS, type **G** and press ENTER.

If you don't know the file name

1. From the Main Menu, type **F** to access the Files Menu. For a list of file areas, type **L** twice. (If you don't type the second *L*, a list of all of the files on the BBS displays.)
2. Mark the file areas you would like to examine by typing each file area's list number and a RETURN.
3. Enter **L** to list all the files in the selected file areas. Enter **C** to go forward in the file list and **P** to go back.
4. Mark one or more files for download by entering **M**, the list numbers of the files, and a RETURN.
5. Enter **D**. A list of the files you marked displays. Enter **E** if you want to edit the list; otherwise, enter **D** again to start the download process.
6. Select a file transfer protocol by typing the indicated letter, such as **Z** for Zmodem (the recommended protocol).
7. If you select Zmodem, the file transfers automatically. If you select another protocol, you may have to initiate the transfer yourself. (In MEWTERM and many other communications programs, PAGE DOWN initiates the download.)
8. When download completes, press ENTER to return to the File Menu.
9. To exit the BBS, type **G** and press ENTER.

## Reading a Message

When you log on, the BBS tells you if you have a message (mail). At the prompt *Would you like to read it now?,* enter **R** to read the message. This is the only point where you can read your mail since you cannot read messages from the Message Menu.

## Leaving a Message

The Multi-Tech BBS has no public discussion area. To leave a personal message, select Message Menu by entering **M** at the Main Menu. Enter **E** and press RETURN to select the Sysop conference. Enter the name of the recipient (or Sysop), the subject, and the message text. Press ESCAPE to finish. Type **S** to save the message and exit. To abort the message at any point, leave any of the fields blank and press RETURN.

## Bulletins

When you log on, the BBS asks if you want to view the bulletin menu. Bulletins are menu driven. To read a bulletin, enter its number. You also can access bulletins by entering **B** at the Main Menu.

# Upgrading the MTA128ST-USB with FlashWizard

The MTA128ST-USB has a flash PROM, which contains firmware code for the hardware. At various times, Multi-Tech may add enhancements and/or fixes to the firmware. The flash technology used in the MTA128ST-USB lets you load these upgrades into the PROM through the MTA128ST-USB's USB port.

## Using FlashWizard to Upgrade Firmware

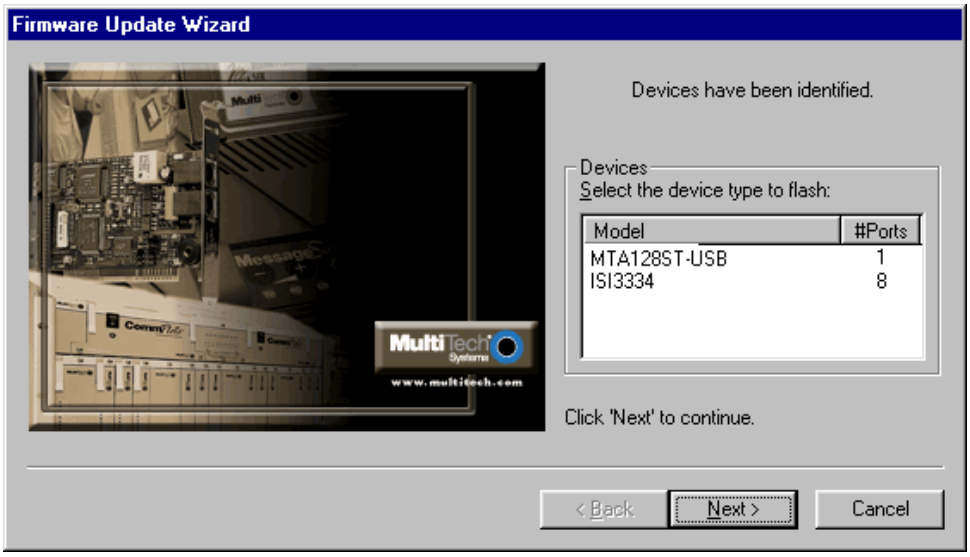
1. Download the Flash Wizard utility and the new .HEX file from the Multi-Tech BBS, FTP site, or Multi-Tech's web site.

   **Note**: You must run the .HEX file in the same directory where the Flash Wizard executable is located. The utility automatically senses the devices on the ports of your PC and automatically finds the .Hex file which is compatible with it. The MTA128ST-USB .Hex files on the FTP site are named according to the Flash Wizard naming convention and will work with the Flash Wizard. If no .Hex files are found in the directory where Flash Wizard is running, the utility exits with an error.

2. Launch the Flash Wizard utility (e.g. double-click on the FlashWiz.exe file from Explorer, enter the file name at the DOS prompt, etc.)

3. The **Firmware Update Wizard** dialog box is displayed indicating that it is identifying devices (may take up to 20 seconds).

4. Once devices have been identified the **Firmware Update Wizard** dialog box indicating that devices have been identified is displayed.




   Select the device(s) you want to flash and then click **Next >**.

5. The **Firmware Update Wizard** dialog box is displayed asking you to select the ports and hex file to update. Once you have made the appropriate selections, click **Next>**.

6. The **Firmware Update Wizard** dialog box is displayed indicating that your devices are being upgraded. This is a three step process including Handshaking, Programming, and Programming Complete. Once finished, click **Next >**.

7. The **Firmware Update Wizard** dialog box is displayed indicating the results of the update (e.g., 8 of 8 devices were updated successfully). Click **Finish**.

   The Update Hardware Wizard completes the update process and disappears from your screen.

# Ordering Accessories

SupplyNet, Inc. supplies replacement transformers, cables and connectors for select Multi-Tech products. You can place an order with SupplyNet via mail, phone, fax or the Internet at:

**Mail:** SupplyNet, Inc.
614 Corporate Way
Valley Cottage, NY 10989

**Phone:** 800 826-0279

**Fax:** 914 267-2420

**Email:** info@thesupplynet.com

**Internet:** http://www.thesupplynet.com

**SupplyNet Online Ordering Instructions**

1. Browse to http://www.thesupplynet.com. In the **Browse by Manufacturer** drop-down list, select **Multi-Tech** and click

2. To order, type in quantity, and click

3. Click

to change your order
4. After you have selected all of your items click

to finalize the order. The SupplyNet site uses Verisign's Secure Socket Layer (SSL) technology to ensure your complete shopping security.

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# Appendixes

MultiTech® Systems

# Appendix A: Regulatory Compliance

### Class B Statement

## FCC Part 15

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC rules.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference that may cause undesired operation.

**Warning**: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numerique de la classe B respecte toutes les exigences du Reglement sur le materiel brouilleur du Canada.

## EMC, Safety, and Terminal Directive Compliance

CE

The CE mark is affixed to this product to confirm compliance with the following European Community Directives:

Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility;

and

Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits;

and

Council Directive 98/13/EC of 12 March 1998 on the approximation of the laws of the Member States concerning telecommunications terminal and satellite earth station equipment.

# Appendix B: Configuration Profiles

# Quick Setup Factory Profiles

For quick setup, the MTA128ST-USB includes six Quick Setup Factory Profiles, each of which is configured for a specific type of port operation. You can load a Quick Setup Factory Profile into active memory by using the command ***&Fn,*** in which *n* is the number of the profile you wish to load. If you wish, you can then customize the profile and store it, using the ***&W*** command, so that it loads automatically when the MTA128ST-USB is turned on or reset. These profiles are stored in permanent memory and are not user-configurable as such.

***&F0*** Profile 0—Modem-like operation (default)

***&F1*** Profile 1—V.110 async operation

***&F2*** Profile 2—V.120 async operation

***&F3*** Profile 3—X.75 async operation

***&F4*** Profile 4—ML-PPP async operation

## Quick Setup Example

The following procedure assumes that you want to load, modify, and store Quick Setup Factory Profile 2 as your default configuration.

1. Select the profile closest to the requirements of your application, in this case— Quick Setup Factory Profile 2.
2. In terminal mode, type ***AT&F2*** and press ENTER. Quick Setup Profile 2 loads into the MTA128ST-USB's active memory.
3. Enter any additional AT commands that you need to customize the selected profile to your application (see Chapter 4, *AT Commands, S-Registers, and Result Codes*).
4. Type ***AT&W0*** and press ENTER to save your customized port configuration.
5. Your customized profile now loads automatically whenever the MTA128ST-USB is turned on or reset.

## Profile 0 (&F0*)* — Modem-Like Asynchronous Operation

| AT COMMAND | DESCRIPTION |
|---|---|
| &C1 | DCD functions normally |
| $D0 | Disable persistent DTR dialing |
| &D1 | Hang up when DTR drops |
| E1 | Enable command mode echo |
| &E4 | Enable hardware flow control |
| &E6 | Discard XON/XOFF characters |
| &E13 | Enable pacing |
| #X0 | Disable Sending Multiple Xoff Characters |
| &J0 | Disable Automatic Channel Bundling |
| %E1 | Enable +++ escape method |
| %E4 | No OK response to +++ or <break> escape |
| &R1 | CTS always high |
| S0=1 | Answer after 1 ring |
| S2=43 | Set escape character to + (ASCII 43) |
| S3=13 | Set carriage return character to CR (ASCII 13) |
| S4=10 | Set line feed character to LF (ASCII 10) |
| S5=8 | Set backspace character to BS (ASCII 8) |
| S7=45 | Wait 45 seconds for connection before aborting |
| S10=20 | Set DCD drop time to 700 ms |
| S25=5 | Set DTR detect time to 500 ms |
| S32=20 | Set escape sequence guard time to 2 seconds |
| S34=2 | Set maximum escape sequence character length |
| S50=1 | Caller Line ID enabled |
| S52=1 | Auto-Protocol Detection enabled |
| S53=2048 | Maximum X.75 buffer size is 2048 characters |
| &S1 | DSR follows DCD |
| V1 | Select verbose messages |
| !Z=x | The data protocol is not modified |

## Profile 1 (&F1*)* — V.110 Asynchronous Operation

| AT COMMAND | DESCRIPTION |
|---|---|
| &C1 | DCD functions normally |
| $D0 | Disable persistent DTR dialing |
| &D1 | Hang up when DTR drops |
| E1 | Enable command mode echo |
| &E4 | Enable hardware flow control |
| &E6 | Discard XON/XOFF characters |
| &E13 | Enable pacing |
| #X0 | Disable Sending Multiple Xoff Characters |
| &J0 | Disable Automatic Channel Bundling |
| %E1 | Enable +++ escape method |
| %E4 | No OK response to +++ or <break> escape |
| &R1 | CTS always high |
| S0=1 | Answer after 1 ring |
| S2=43 | Set escape character to + (ASCII 43) |
| S3=13 | Set carriage return character to CR (ASCII 13) |
| S4=10 | Set line feed character to LF (ASCII 10) |
| S5=8 | Set backspace character to BS (ASCII 8) |
| S7=45 | Wait 45 seconds for connection before aborting |
| S10=20 | Set DCD drop time to 700 ms |
| S25=5 | Set DTR detect time to 500 ms |
| S32=20 | Set escape sequence guard time to 2 seconds |
| S34=2 | Set maximum escape sequence character length |
| S50=1 | Caller Line ID enabled |
| S52=1 | Auto-Protocol Detection enabled |
| S53=2048 | Maximum X.75 buffer size is 2048 characters |
| &S1 | DSR follows DCD |
| V1 | Select verbose messages |
| !Z=6 | Enable V.110 data protocol |

## Profile 2 (&F2*)* — V.120 Asynchronous Operation

| AT COMMAND | DESCRIPTION |
|---|---|
| &C1 | DCD functions normally |
| $D0 | Disable persistent DTR dialing |
| &D1 | Hang up when DTR drops |
| E1 | Enable command mode echo |
| &E4 | Enable hardware flow control |
| &E6 | Discard XON/XOFF characters |
| &E13 | Enable pacing |
| #X0 | Disable Sending Multiple Xoff Characters |
| &J0 | Disable Automatic Channel Bundling |
| %E1 | Enable +++ escape method |
| %E4 | No OK response to +++ or <break> escape |
| &R1 | CTS always high |
| S0=1 | Answer after 1 ring |
| S2=43 | Set escape character to + (ASCII 43) |
| S3=13 | Set carriage return character to CR (ASCII 13) |
| S4=10 | Set line feed character to LF (ASCII 10) |
| S5=8 | Set backspace character to BS (ASCII 8) |
| S7=45 | Wait 45 seconds for connection before aborting |
| S10=20 | Set DCD drop time to 700 ms |
| S25=5 | Set DTR detect time to 500 ms |
| S32=20 | Set escape sequence guard time to 2 seconds |
| S34=2 | Set maximum escape sequence character length |
| S50=1 | Caller Line ID enabled |
| S52=1 | Auto-Protocol Detection enabled |
| S53=2048 | Maximum X.75 buffer size is 2048 characters |
| &S1 | DSR follows DCD |
| V1 | Select verbose messages |
| !Z=5 | Enable V.120 data protocol |

## Profile 3 (&F3*)* — X.75 Asynchronous Operation

| AT COMMAND | DESCRIPTION |
|---|---|
| &C1 | DCD functions normally |
| $D0 | Disable persistent DTR dialing |
| &D1 | Hang up when DTR drops |
| E1 | Enable command mode echo |
| &E4 | Enable hardware flow control |
| &E6 | Discard XON/XOFF characters |
| &E13 | Enable pacing |
| #X0 | Disable Sending Multiple Xoff Characters |
| &J0 | Disable Automatic Channel Bundling |
| %E1 | Enable +++ escape method |
| %E4 | No OK response to +++ or <break> escape |
| &R1 | CTS always high |
| S0=1 | Answer after 1 ring |
| S2=43 | Set escape character to + (ASCII 43) |
| S3=13 | Set carriage return character to CR (ASCII 13) |
| S4=10 | Set line feed character to LF (ASCII 10) |
| S5=8 | Set backspace character to BS (ASCII 8) |
| S7=45 | Wait 45 seconds for connection before aborting |
| S10=20 | Set DCD drop time to 700 ms |
| S25=5 | Set DTR detect time to 500 ms |
| S32=20 | Set escape sequence guard time to 2 seconds |
| S34=2 | Set maximum escape sequence character length |
| S50=1 | Caller Line ID enabled |
| S52=1 | Auto-Protocol Detection enabled |
| S53=2048 | Maximum X.75 buffer size is 2048 characters |
| &S1 | DSR follows DCD |
| V1 | Select verbose messages |
| !Z=12 | Enable X.75 data protocol |

## Profile 4 (&F4*)* — ML-PPP Asynchronous Operation

| AT COMMAND | DESCRIPTION |
|---|---|
| &C1 | DCD functions normally |
| $D0 | Disable persistent DTR dialing |
| &D1 | Hang up when DTR drops |
| E1 | Enable command mode echo |
| &E4 | Enable hardware flow control |
| &E6 | Discard XON/XOFF characters |
| &E13 | Enable pacing |
| #X0 | Disable Sending Multiple Xoff Characters |
| &J0 | Disable Automatic Channel Bundling |
| %E1 | Enable +++ escape method |
| %E4 | No OK response to +++ or <break> escape |
| &JMh | |

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# Glossary

MultiTech® Systems

**Symbol**

**2B1Q** (2 bits, 1 quarternary)**—**A line code at layer one for the BRI U interface. Two bits of data (2B) are mapped into one of four line values (1Q, or 1quarternary). This coding scheme allows a single copper pair to carry 160 Kbps of information bidirectionally and simultaneously at a distance of up to three miles.

**A**

**ACK** (acknowledgement code)—A communications code sent from a receiving modem to a transmitting modem to indicate that it is ready to accept data. It is also used to acknowledge the error-free receipt of transmitted data. Contrast with *NAK*.

**address—**A numbered location inside a computer. The computer uses addresses to access resources such as video cards, USB ports, memory, etc.

**analog signal—**A waveform that has amplitude, frequency, and phase, which takes on a range of values between its maximum and minimum points.

**analog transmission—**A type of telecommunications that uses an analog signal as a carrier of voice, data, video, etc. An analog signal becomes a carrier when it is modulated by altering its phase, amplitude, and/or frequency to correspond with the source signal. Compare with digital transmission.

**API (application program interface)—**A software module created to allow dissimilar, or incompatible applications programs to transfer information over a communications link. APIs may be simple or complex; they are commonly required to link computer applications with mainframe programs.

**ASCII** (American Standard Code for Information Interchange)—Pronounced *ass-key*. A binary code for data that is used in communications and in many computers and terminals. The code is used to represent numbers, letters, punctuation, and control characters. The basic ASCII code is a 7-bit character set, which defines 128 possible characters. The extended 8-bit ASCII code defines 255 characters.

**ASI** (application services interface)—A software module that creates the interface between a LAN-connected PC and the network operating system. ASIs packetize computer data for transport over the network. NASI, NCSI, MCSI and NETCI are specific examples.

**AT commands—**A standard set of commands used to control modems. Each AT command string begins with the characters *AT*, which get the *attention* of the modem before the actual command is issued. See also *command mode*.

**B**

**background—**An activity that takes place in the computer while you are running another application. In other words, the active user interface does not correspond to the background task.

**bandwidth—**The transmission capacity of a computer channel, communications line or bus. It is expressed in cycles per second (hertz), the bandwidth being the difference between the lowest and highest frequencies transmitted. The range of usable frequencies that a transmission medium will pass without unacceptable attenuation or distortion. Bandwidth is a factor in determining the amount of information and the speed at which a medium can transmit data or other information.

**basic access—**A term that describes a simple standardized combination of access channels that constitute the access arrangements for most ISDN users.

**B-channel** (bearer channel)—A 64 Kbps ISDN channel used for digital high-speed data or voice transmission. Simultaneous voice and data transmission requires subscription to two B-channels. A voice call can be placed or received while a data call is in process (or vice versa); however, two simultaneous voice or two simultaneous data calls are not supported.

**bearer capability** (BC)—The level of functionality provided by the ISDN B-channel (e.g., data, 3.1 KHz audio, etc.).

**bearer services—**A set of ISDN functions provided by the B-channel, such as digital telephony, toll-free inbound/outbound calls, 64 Kbps circuit switched data, X.25 packet switched data, and frame relay data.

**bit**—A bit (binary digit) is a basic unit of information used in computing and other digital electronics. It can take a value of either 1 or 0, represented in a computer by a high or low electrical charge.

**BONDING** (Bandwidth on Demand Interoperability Group)—An inverse multiplexing method that combines multiple ISDN channels into a single channel for enhanced throughput. Trademark of the BONDING Consortium.

**BONDING mode 1—**An industry-standard ISDN B channel aggregation protocol that was developed by the Bandwidth On Demand Interoperability Group. This mode supports user data rates that are multiples of the bearer rate. It provides the full available bandwidth, but no in-band monitoring. Mode 1 is common to all implementations of BONDING; Modes 0, 2, and 3 are optional.

**BONDING Consortium—**A group that develops specifications for common control and synchronization for management of high-speed data over the public network.

**BONDING Specification 1.0—** The Version 1.0 BONDING specification (August 1992) defines four modes of inverse multiplexing interoperability. It allows devices from various manufacturers to subdivide a wideband signal into 64 Kbps or 56 Kbps channels, and then pass the individual channels over a switched digital network, recombining them into a single high-speed signal at the receiving device.

**BONDING Specification 1.1—** The Version 1.1 BONDING specification (September 1993) incorporates changes to the 1.0 specification resulting from interworking tests among various vendors, and comments from the TIA standardization process. No changes were made to the BONDING algorithm or procedures.

**bps** (bits per second)—The unit of speed at which data bits can be transmitted or received. Bps differs from baud when more than one bit is represented by a single cycle of the carrier.

**BRI** (basic rate interface)—Also called 2B+D. One of two forms of ISDN service. BRI provides two 64 Kbps B-channels for video, voice or data, and one 16 Kbps D-channel for control information. The total BRI data rate is 192 Kbps, with 144 Kbps available to the user. See also *ISDN* and *PRI.*

**buffer**—A temporary storage register or random access memory (RAM), used in all aspects of data communications, that prevents data from being lost due to differences in transmission speed. Keyboards, USB ports, muxes and printers are a few examples of devices that contain buffers.

**bus—**A common channel between hardware devices, either internally between components in a computer, or externally between stations in a communications network.

**byte—**A unit of information consisting of eight binary digits (bits). A byte holds the equivalent of a single or character (such as the letter A).

**C**

**call setup time—**The time to establish a circuit-switched call between two points. Includes dialing, wait time, and central office–long distance service movement time.

**carrier signal—**An analog signal with known frequency, amplitude and phase characteristics used as a transport facility for useful information. By knowing the original characteristics, a receiver can interpret any changes as modulations, and thereby recover the information.

**Centrex—**A multi-line service, offered by telephone companies, that provides functions and features comparable to those of a PBX for large business users. See also *PBX*, *exchange*.

**channel—**A data communications path between two computer devices. It can refer to a physical medium (e.g., UTP or coax), or to a specific carrier frequency. In ISDN, two types of channels are specified: transparent (user can define the service), and nontransparent (service is assigned protocols for specific network functions). ISDN channel names are designated by a single letter, from A through M, sometimes combined with a number (see *B-channel* and *D-channel*).

**circuit-switched network—**A technology used by the PSTN that allocates a pair of conductors for the exclusive use of one communication path. Circuit switching allows multiple conversations on one talk path only if end users multiplex signals prior to transmission.

**circuit switching—**The temporary connection of two or more communications channels using a fixed, non-shareable path through the network. Users have full use of the circuit until the connection is terminated.

**CO** (central office)—The lowest, most basic, level of switching in the PSTN (public switched telephone network). A business PABX or any residential telephone connects to the PSTN at a central office.

**COM port—**A serial communications port on a personal computer. Normally, there are two: COM1 and COM2.

**CPE** (customer premise equipment)—The generic term for data communications and/or terminal equipment that resides at the user site and is owned by the user (e.g., not telephone company equipment).

**D**

**DCE** (data communications equipment)—Any device that serves as the port of entry from the user equipment to a telecommunications facility. A modem is a DCE for the telephone network (PSTN) that is commonly on site at the user's premises. Packet Switched Networks have another level of DCE that is most often located at a central office.

**D-channel—**A non-ransparent digital ISDN channel that operates at 16 K or 64 Kbps, used for call control signalling, along with one or more B-channels. The D (demand) channel signal can control call setup, call teardown, and invocation of Supplementary Services. Is also used for telemetry and for low-speed, low-priority packet-switched data. Contrast with *B-channel*.

**default—**A preset value or option in software packages or in hardware configuration that is used unless you specify otherwise.

**default address**: an address defined by the Universal Serial Bus Specification and used by a Universal Serial Bus device when it is first powered or reset. The default address is 00h.

**default pipe**: the message pipe created by Universal Serial Bus system software to pass control and status information between the host and a Universal Serial Bus device's Endpoint 0.

**device**: a logical or physical entity that performs a function. The actual entity described depends on the context of the reference. At the lowest level, device may refer to a single hardware component, as in a memory device. At a higher level, it may refer to a collection of hardware components that perform a particular function, such as a Universal Serial Bus interface device. At an even higher level, device may refer to the function performed by an entity attached to the Universal Serial Bus; for example, a data/FAX modem device. Devices may be physical, electrical, addressable, and logical. When used as a non-specific reference, a Universal Serial Bus device is either a hub or a function.

**device address**: the address of a device on the Universal Serial Bus. The Device Address is the Default Address when the Universal Serial Bus device is first powered or reset. Hubs and functions are assigned a unique Device Address by Universal Serial Bus software.

**device driver—**Software that controls how a computer communicates with a device, such as a printer or mouse.

**digital data—**Information represented by descrete values or conditions (contrast *analog data*).

**digital PBX—**A private branch exchange that operates internally on digital signals. See also *exchange*.

**digital signal—** A discrete or discontinuous signal (e.g., a sequence of voltage pulses). Digital devices, such as as a series of electrical pulses that have discrete jumps rather than gradual changes.

**digital transmission**—A method of electronic information transmission common among computers and other digital devices. Because a digital signal may be only *high* or *low* at any given time, noise and distortion can easily be removed from digital transmissions.

**digitize**—To convert an analog signal to a digital signal.

**DIP switch**—Pronounced *dip switch*. A set of tiny toggle switches, built into a DIP (dual in-line package), used for setting configurable parameters on a printed circuit board.

**DN** (directory number)—The phone number assigned to an ISDN TA at subscription time. It is a string of up to 24 characters, consisting of the valid dialing characters (0-9, *, and #).

**driver**—A software module that interfaces between the operating system and a specific hardware device (e.g., color monitors, printers, hard disks, etc.). Also known as a device driver.

**DTE** (data terminating equipment)—A term used to include any device in a network which generates, stores or displays user information. DTE is a telecommunications term that usually refers to PCs, terminals, printers, etc.

**DTMF** (dual-tone multifrequency)—A generic push-button concept made popular by AT&T TouchTone.

**DTMF detection**—A capability in some fax/data modems that can differentiate between DTMF or fax calling tones. A typical application would be a program that routes calls to specific communications applications, depending either on the type of call or on a DTMF tone added to a dialing string.

**E**

**EEPROM** (electrically eraseable programmable read-only memory)—A permanent memory chip that can be reprogrammed by the customer after the manufacturer has set initial values. See also *ROM*.

**EISA** (Enhanced Industry Standard Architecture)—Pronounced *eesa*. The purpose of the EISA bus is to provide a 32-bit bus for faster throughputs while maintaining backward compatibility with the classic ISA bus architecture.

**ET** (exchange termination)—The carrier's local exchange switch. Contrast with *LT (loop termination)*.

**exchange**—A unit (public or private) that can consist of one or more central offices established to serve a specified area. An exchange typically has a single rate of charges (tariffs) that has previously been approved by a regulatory group.

**exchange area—**A geographical area with a uniform set of charges (tariffs), approved by a regulatory group for telephone services. Calls between any two points within an exchange area are local calls. See *digital PBX* and *PBX*.

**F**

**fax** (facsimile)—Refers to the bit-mapped rendition of a graphics-oriented document (fax) or to the electronic transmission of the image over telephone lines bit-mapped approximation of a graphical document and, therefore, cannot be accurately interpreted according to any character code.

**firmware**—Software that is stored in read-only memory (ROM). Unlike random access memory (RAM), ROM can retain its content without electrical power. Some ROM, known as EEPROM, can be reprogrammed electrically while it is in a device.

**foreground**—The application program currently running on and in control of the PC screen and keyboard. The area of the screen that occupies the active window. Compare with *background*.

**frequency**—A characteristic of an electrical or electronic signal which describes the periodic recurrence of cycles. Frequency is inversely proportional to the wavelength or pulse width of the signal (e.g., long wavelength signals have low frequencies and short wavelength signals yield high frequencies).

**function**: A Universal Serial Bus device that provides a capability to the host. For example, an ISDN connection, a digital microphone, or speakers.

**H**

**handshaking**—A process that two modems go through at the time of call setup to establish synchronization over the data communications link. It is a synchronization and negotiation process accomplished by the exchange of predefined, mutually recognized control codes.

**HDLC** (High-Level Data Link Control)—An ISO standard, bit-oriented data communications protocol that provides nearly error-free data transfers.

**hexadecimal**—A base 16 numbering system in which one character represents a four-bit binary value. Hexadecimal notation uses the numbers 0–9 and the letters A–F, usually suffixed by an *h* (e.g., 4CF h).

**Host Controller**: The host's Universal Serial Bus interface. A hardware device that provides the interface to the Host Controller Driver (HCD) and the USB bus.

**Host Controller Driver (HCD)**: Software that provides an interface to the USB Driver and the Host Controller. (The interface to the Host Controller is defined by the OHCI specification.

**I**

**IDN** (Integrated Digital Network)**—**The culmination of transmission and switching functions using digital technology in a circuit-switched telecommunications network.

**IEC** (Inter-Exchange Carrier)—A telephone company that is allowed to provide long distance telephone service between LATAs, but not within any one LATA. Also called *IXC*.

**I-mux** (inverse multiplexer)—A device that will dial up and combine several lower speed circuits into a virtual broadband circuit. It takes any multiple up to an aggregate bandwidth, giving users *bandwidth on demand* for videoconferencing, LAN-to-LAN connections, etc. In ISDN devices, inverse multiplexing is performed by the BONDING protocol.

**in-band signaling**—A technique in which connection control information is sent over the same channel as assigned to the subscriber for end-to-end communication. Two common examples are DTMF line signaling and MF trunk signaling.

**Internet**—A computer network consisting of many millions of university, government, and private users around the world.

**Internet address**—A unique 32-bit address for a specific TCP/IP host on a network. Normally printed in dotted decimal format (e.g., 129.128.44.227).

**I/O address**—A location within the I/O address space of your computer used by a device, such as an expansion card, a USB port, or an internal modem. The address is used for communication between software and a device.

**IP address**—A unique 32-bit address for a specific TCP/IP host on a network. Normally printed in dotted decimal format (e.g., 129.128.44.227).

**IRQ** (interrupt request)—The notification a processor receives when another portion of the computer's hardware requires its attention. IRQs are numbered so that the device issuing the IRQ can be identified, and so that IRQs can be prioritized.

**ISA** (Industry Standards Architecture)—Pronounced *ice-a*. The classic 8- or 16-bit architecture introduced with IBM's PC-AT computer. Due to speed constraints, IBM later introduced a restructured Micro Channel Architecture with a 32-bit bus and increased addressing capabilities.

**ISDN** (Integrated Services Digital Network)—International telecommunications standard for transmitting voice, video and data over a digital communications line.

**ITU-T** (formerly CCITT)—International Telecommunications Union–Telecommunications Sector; the United Nations organization that prepares standards for resolving communications issues and problems.

**L**

**LAPB** (Link Access Procedure Balanced)—Based on the X.25 Layer 2 specification. A full-duplex, point-to-point, bit-synchronous protocol commonly used as a data link control protocol to interface X.25 DTEs. LAPB is the link initialization procedure that establishes and maintains communications between the DTE and the DCE.

**LAPD** (Link Access Protocol for the D-Channel)—Based on the ISDN Q.921 specification. A full-duplex point-to-point bit-synchronous link-level protocol for ISDN connections; different from LAPB in its framing sequence. Transmission is in units called *frames*, and a frame may contain one or more X.25 packets.

**link optimization**—An ISDN feature that permits only user data to open the communications link and keeps administrative packets from opening the link. A cost saving feature that ensures that remote connections are not unnecessarily utilized.

**local loop**—A transmission path, typically twisted-pair wire, between an individual subscriber and the nearest public telecommunications network switching center. Also called the *subscriber loop*.

**LT** (loop termination)—A device, similar to an NT1, that terminates the local loop at the carrier's central switching office. The LT provides the interface to the ISDN U reference point. Contrast *ET (exchange termination)*.

**M**

**ML-PPP** (Multilink PPP)—An open standard for inverse multiplexing, allowing two 64 bps ISDN B channels to be multiplexed into one 128 Kbps link.

**modem**—A communications device that enables a computer to transmit information over a telephone line. It converts the computer's digital signals into analog signals to send over a telephone line and converts them back to digital signals at the receiving end. Modems can be internal and fit into an expansion slot, or external and connect to a USB port.

**MSN** (Multiple Subscriber Number) - Allows a caller to specify an individual terminal adapter when more than one unit is connected to your network terminator. An MSN consists of a base address and a subaddress. If you assisgn a base address only, the unit accepts any incoming call with the same base address, regardless of whether a subaddress is included. If you assign a base address and a subaddress, the unit only accepts calls that match both the base address and the subaddress.

**multilink**—In point-to-point protocol, literally *many links*. A procedure used to route data packets over many links for increased bandwidth (e.g., two B-channels on a single BRI for 128 Kbps).

**mux** (multiplexer)—A device that merges several signals into one composite signal for transmission over a single medium or channel. A demultiplexer, built into most muxes, reverses the process at the receiving end.

**N**

**nailed connection**—A permanent or dedicated circuit of a previously switched circuit or circuits.

**nailed-up circuit**—A semi-permanent circuit established through a circuit-switching facility for point-to-point connectivity.

**NAK** (negative acknowledgment)—A communications code used to indicate that a message was not properly received, or that a terminal does not wish to transmit. Contrast with *ACK*.

**network**—A group of computers connected by cables or other means and using software that enables them to share equipment, such as printers and disk drives to exchange information.

**NI-1** (National ISDN-1)—A physical standard to make all compliant ISDN lines appear the same. With ISDN-1 installed, additional costs are not incurred when changing from prestandard ISDN to *standard* ISDN. Most RBOCs now are moving to ISDN-1.

**NI-2** (National ISDN-2)—A physical standard subsequent to NI1. When tested and deployed, NI-2 will provide additional features and enhanced *plug and play* capabilities.

**node**—Any point within a network that has been assigned an address.

**NT** (network termination)—Devices that form the boundary between customer premise equipment and telephone company equipment. Two types of NTs are used: NT1 and NT2.

**NT1** (Network TerminationType 1)—An interface device used in the BRI portion of ISDN to connect four-wire (S/T) ISDN devices to the two-wire (2BIQ U) IDN. It provides basic rate access in a 2B+D format with two 64 bps channels for voice, data, and video communications. It also provides one 16 Kbps channel for packet-mode signalling, low-speed data and telecommunications services at the OSI Layer 1 level. Similar in function to a DSU/CSU device.

**NT2** (Network TerminationType 2)—A device at the customer premise (user) side responsible for the ISDN network connection and for functions such as multiplexing and switching (may be an intelligent device).

**NTE** (network terminating equipment)—A set of ISDN functions residing at the boundary of the IDN and the subscriber.

**NUI** (network user identification)—A unique alphanumeric number provided to dial-up users to identify them to packet-switched networks world-wide. The number is used for network access and billing.

**O**

**OHCI (OpenHCI)**: Open Host Controller Interface Specification for USB. All transfers on the USB are initiated by the host system's host controller. The host controller is responsible for controlling traffic on the USB and can be appropriately programmed to transfer data to and from USB devices. This is typically a PCI device that can be programmed to run a given schedule of transfers on the USB and bus master the results into memory for processing by the host software. There are currently two standards for host controllers: OpenHCI (OHCI or Open Host Controller Interface) and UHCI (Universal Host Controller Interface). Both these standards define register level interfaces of the host controller to PCI bus. Bandwidth allocation over the USB is software managed and is done by the programming of the host controller.

**off-hook**—The condition of a device that has accessed a phone line (with or without using the line). In modem use, this is equivalent to a telephone handset being picked up. Dialing and transmission are allowed, but incoming calls are not answered.

**on-demand dialing**—A cost-saving feature of ISDN that sets up, transfers, and then closes a call only when the ISDN device detects a *data* packet addressed to the remote network, but will not perform setup/transfers of just administrative (non-user data) packets.

**out-of-band signaling**—A system that uses a separate communications channel or frequency outside the voice band for signaling. Modern systems use a separate channel, either TDM or virtual. SS7 uses messages for signaling that are carried on signaling links distinct from voice channels. ISDN uses messages for signaling that are carried on the
D-channel distinct from the voice carried on the B-channels. Frame Relay and ATM use messages that are carried on a separate virtual connection reserved for signaling.

**on-hook**—The condition of a device which has not accessed a phone line. In modem use, this is equivalent to a telephone handset that has not been picked up. In other words, it can receive an incoming call.

**P**

**packet data**—Packet-mode calls.

**packet mode**—The switching of chunks of information for different users using statistical multiplexing to send them over the same transmission facility. ISDN packet mode capabilities are based on the ITU-TSS Recommendation X.25 procedures.

**parity bit**—An extra bit attached to each byte of synchronous data used to detect errors in transmission.

**PBX** (private branch exchange)—A telephone exchange located on the customer's premises. The PBX provides a circuit switching facility for tlephone extension lines within the building, and access to the public telephone network. See also *exchange*.

**P-channel** (PCHAN)—The ISDN physical channel identification; contrast logical channel or virtual channel.

**PDN** (public data network)—A packet-switched network that is available to the public for individual (subscriber) use. Typically, controlled by a government or a national monopoly.

**Plug and Play (PnP)**: A technology for configuring I/O devices to use non-conflicting resources in a host. Resources managed by Plug and Play include I/O address ranges, memory address ranges, IRQs, and DMA channels.

**port**—A location for input or output data exchange. Computers, muxes, etc. have ports for various purposes.

**PPP** (Point to Point Protocol)—A protocol that lets a computer user access a TCP/IP address using an ISDN terminal adapter or a high-speed modem over a standard telephone line.

**PRI** (Primary Rate Interface)—One
of two forms of ISDN service. PRI provides 23 64 Kbps B-channels for video, voice or data, and one 64 Kbps D-channel for control information. Usually used to connect high-cpacity CPE, such as PBXs, to the network. Also called *23B+D* in the U.S. and *30B+D* in Europe.) See also *ISDN* and *BRI*.

**primitive**—An abstract representation of interaction accross the access points indicating that information is being passed between the service user and the service provider. The OSI Reference Model defines four types of primitives: Request, Indication, Response and Confirm.

**PSTN** (public switched telephone network)—The group of circuit-switching voice carriers, which are commonly used as analog data communications services. A worldwide public voice telephone network that is used as a telecommunications medium for the transmission of voice, data and other information.

**pulse dialing**—One of two methods of dialing a telephone, usually associated with rotary-dial phones. Compare with *tone dialing*.

**PVC** (permanent virtual circuit)**—**A connection between two endpoints dedicated to a single user. In ISDN, PVCs are established by network administration and are held for as long as the user subscribes to the service.

**Q**

**Q.921**—The ITU-T recommendation for user-network interface layer 2 specifications for D-channel signaling. Similar to LAPD. See also *ISDN*.

**Q.931**—The ITU-T recommendation for user-network interface layer 3 specifications for D-channel signalling. See also *ISDN*.

**R**

**R reference point**—Establishes the boundary between non-ISDN compatible equipment (TE-2) and the IDN network. TAs are used to convert the communication protocol used by the non-ISDN termnials to the desired BRI or PRI protocol. Non-ISDN (TE2) terminal equipment connects to IDN at the R-Reference point with a TA. (This interface may follow the RS232 or V.35 specification.) Also called the R interface. (Contrast *S reference point*.)

**RAM** (random access memory)—A computer's primary workspace. All data must be stored in RAM (even for a short while), before software can use the processor to manipulate the data. Before a PC can do anything useful it must move programs from disk to RAM. When you turn it off, all information in RAM is lost.

**reference point**—A connection point between ISDN equipment classes (rather than the specific protocol of the interconnection). Can include R, S, T, and U reference points.

**RJ-11**—An industry standard interface used for connecting a telephone to a modular wall outlet; comes in 4-and 6-wire packages.

**RJ-45**—An 8-wire modular connector for voice and data circuits.

**RPOA** (recognized private operating agency)—A corporation, private or government-controlled, that provides telecommunications services. RPOAs, such as AT&T, participate as non-voting members in the ITU-T.

**S**

**S reference point**—Provides the connection between NT2 equipment and the TA or TE-1. Can provide both primary and basic rate services. Also called the S-interface. (Contrast *R-reference point*.)

**SAP** (service access point)—A point at which the services of an OSI layer are made available to the next higher layer. See also *SAPI*.

**SAPI** (service access point identifier)—A logical point at which data link layer services are provided by a data link layer entity to a layer 3 entity. See also *SAP*.

**service**—The requirements offered by an RPOA to its customers to satisfy specific telecommunications needs.

**signaling**—The process of establishing, maintaining, accounting for, and terminating a connection between two endpoints (e.g., the user premises and the telco CO). Central office signals to the user premises can include ringing, dial tone, speech signals, etc. Signals from the user's telephone can include off-hook, dialing, speech to far-end party, and on-hook signals.

In-band signaling techniques include pulse and tone dialing. With common channel signaling, information is carried out-of-band. In ISDN, signaling includes the call establishment, call progress monitoring, call termination and enhanced telephone features provided typically by the D-Channel. See also *SS7*, *out-of-band signaling*, and *in-band signaling*.

**SPID** (service profile identifier)—In North America, the ISDN network parameter for logical terminal identification and tracking, provided by the ISDN provider. The voice SPID and data SPID identify a particular set of service or feature parameters. They are assigned by the ISDN service provider in the form of a string of up to 20 characters at subscription time. The SPID actually points to a specific location in central office memory where the relevant information is stored.

**SS7** (Signaling System 7)—An ITU-T and ANSI standard for digital out-of-band signalling between central offices that provides much of the network switching intelligence to support many ISDN functions

**stop bit**—One of the variables used for timing in asynchronous data transmission. Depending on the devices, each character may be trailed by 1, 1.5, or 2 stop bits.

**subscriber loop**—The pair of wires that connect the end user to the telephone network. These wires provide ISDN service, but also require an NT1 at the enduser location as well as the LT at the network end. See also *local loop*.

**supplementary services** (SS)—ISDN functions beyond the basic requirements; includes videoconferencing, fast dialing, call waiting, call forwarding, calling line ID.

**SVC** (switched virtual circuit)**—**A type of data transmission where the connection is maintained only until the call is cleared.

**SVD** (simultaneous voice and data)—A technology for letting a user send data via a modem, and use a handset to talk to another user at the same time over the same connection. The alternative, making a second call, can be expensive or even impossible. The uses for SVD are telecommuting, videoconferencing, distant learning, tech support, etc.

**switched 56**—A circuit-switched (full duplex digital synchronous data transmission) service that lets you dial a number and transmit data to it at 56 Kbps. It is a relatively low cost service, widely used in North America for telecommuting, videoconferencing and high speed data transfers. Many phone companies are phasing out switched 56 in favor of ISDN service.

**switched line**—In communications, a physical channel established by dynamically connecting one or more discreet segments. This connection lasts for the duration of the call after which each segment may be used as part of a different channel. Contrast with leased line.

**switched network**—A network in which a temporary connection is established from one point via one or more segments.

**synchronous transmission**—The transmission of data which involves sending a group of characters in a packet. This is a common method of transmission between computers on a network or between modems. One or more synchronous characters are transmitted to confirm clocking before each packet of data is transmitted. Compare to Asynchronous Transmission.

**T**

**T**—Provides the connection between the NT1 and NT2. Can be internal to or external from the PABX. Provides the connection between the NT1 equipment and the TA or TE-1. Can provide both Primary Rate and Basic Rate services.

**TA**—See *terminal adapter*.

**TCP/IP** (Transmission Control Protocol / Internet Protocol)—A multi-layer set of protocols developed by the US Department of Defense to link dissimilar computers across dissimilar and unreliable LANs.

**TEI** (terminal endpoint identifier)—A unique number that is assigned to an ISDN terminal adapter at subscription time. The TEI is used by the central office to identify the various TAs connected to the ISDN network. The TEI number can be fixed (in the range of 0-63), dynamically, or automatically assigned at the CO each time the TA is connected to the ISDN interface and powered up.

**TE1** (Terminal Equipment Type 1)—A terminal device with a standard ISDN interface (an ISDN-compatible terminal).

**TE2** (Terminal Equipment Type 2)—A terminal device with a non-ISDN interface, such as RS232, RS449, V.35 or X.21. Can be a telephone, data terminal, or voice/data worrkstation, etc.

**telecommunication service**—A function, such as bearer service and teleservice, offered by an RPOA to its customer in order to satisfy a specific telecommunications requirement. See also *ISDN*, *RPOA*, and *bearer service*.

**telematics**—User-oriented ISDN information transfer services (e.g., teletex, videotex, facsimile).

**Teleservices**—A telecommunications service that provides the complete capability for communication between subscribers according to protocols agreed to by RPOAs. A set of ISDN features using communications links, including E-Mail and fax services.

**Teletext**—A telecommunications service that provides a one-way information retrieval service that uses unused portions of a TV channel bandwidth. A fixed number of text pages are repetitively broadcast for decoding by a decoder at the TV set that can select and display pages. See also *ISDN*.

**terminal**—The screen and keyboard device used in a mainframe environment for interactive data entry. Terminals have no *box*, which is to say they have no file storage or processing capabilities.

**terminal adapter** (TA)—An ISDN DTE device for connecting a non-ISDN terminal device to the ISDN network. Similar to a protocol converter or an interface converter, a TA connects a non-ISDN device between the R and S interfaces.

**tone dialing**—One of two methods of dialing a telephone, usually associated with Touch-Tone® (push button) phones. Compare with *pulse dialing*.

**TSR** (terminate and stay resident)—A software program that remains active and in memory after its user interface is closed. Similar to a daemon in UNIX environments.

**twisted pair wiring**—A type of cabling with one or more pairs of insulated wires wrapped around each other. An inexpensive wiring method used for LAN and telephone applications, also called UTP wiring.

**Type A**: The upstream (USB Type A) connector. A Type A Connector is for those devices on which the external cable is permanently attached. Connectors for USB come in two designs: the 'A' and 'B' types. Upstream connections (computer, hub input, etc.) are made using the 'A' type connector, downstream connections (peripherals, hub outputs) are made using the 'B' type connector. The USB spec defines two types of connectors to protect the bus from illegal topologies (e.g., connecting one downstream port back to another, etc.) and to prevent end-user confusion. This allows end users to easily attach the correct connectors to peripherals and ports. Type A Plug and receptacle are to be used for those devices on which the external cable is permanently attached to devices such as Keyboard, mouse and hubs. Series B Plug and receptacle are to be used for those devices that require an external detachable cable such as printers, scanners and modems.

**Type B:** The uplink (USB Type B) connector. A Type B Connector is for detachable external cables. Allows for double ended cable assemblies. Connectors for USB come in two designs: the 'A' and 'B' types. Upstream connections (computer, hub input, etc.) are made using the 'A' type connector, downstream connections (peripherals, hub outputs) are made using the 'B' type connector. The USB spec defines two types of connectors to protect the bus from illegal topologies (e.g., connecting one downstream port back to another, etc.) and to prevent end-user confusion. This allows end users to easily attach the correct connectors to peripherals and ports. Type A Plug and receptacle are to be used for those devices on which the external cable is permanently attached to devices such as Keyboard, mouse and hubs. Series B Plug and receptacle are used for devices that require an external detachable cable such as printers, scanners and modems.

**U**

**U reference point**—A twisted-pair subscriber loop that connects the LT to the NT1. Normally a 2-wire BRI or PRI line is used, but a 4-wire BRI can also be used. In the US, the U Reference Point marks the separation point between CPE and the network.

**UHCI (Universal Host Controller Interface)**: The USB Universal Host Controller Interface. All transfers on the USB are initiated by the host system's host controller. The host controller is responsible for controlling traffic on the USB and can be appropriately programmed to transfer data to and from USB devices. This is typically a PCI device that can be programmed to run a given schedule of transfers on the USB and bus master the results into memory for processing by the host software. There are currently two standards for host controllers: OpenHCI (OHCI or Open Host Controller Interface) and UHCI (Universal Host Controller Interface). Both these standards define register level interfaces of the host controller to PCI bus. Bandwidth allocation over the USB is software managed and is done by the programming of the host controller.

**Universal Serial Bus**: A collection of Universal Serial Bus devices and the software and hardware that allow them to connect the capabilities provided by functions to the host.

**Universal Serial Bus Device**: Includes hubs and functions. See device.

**Universal Serial Bus Driver**: The host resident software entity responsible for providing common services to clients that are manipulating one or more functions on one or more Host Controllers.

**Universal Serial Bus Interface**: The hardware interface between the Universal Serial Bus cable and a Universal Serial Bus device. This includes the protocol engine required for all Universal Serial Bus devices to be able to receive and send packets.

**Unshielded Twisted Pair (UTP):** Telephone-type wiring. Tansmission media for 10Base-T.

**Upstream**: The direction of data flow towards the host. An upstream port is the port on a device electrically closest to the host that generates upstream data traffic from the hub. Upstream ports receive downstream data traffic.

**USB:** See Universal Serial Bus.

**USBD**: See Universal Serial Bus Driver.

**USB Performance categories**: Low Speed (Interactive Devices at 10-100 Kb/s); Medium Speed (Phone, Audio, Compressed Video at 500Kb/s - 10Mbp/s); High Speed (Video, Disk at 25-500 Mb/s)

**UTP** (unshielded twisted pair) —Telephone-type wiring.

**V**

**V.110**—One of the terminal rate adaptation protocols for the ISDN B-channel. V.110 is more hardware-intensive than the V.120 B-channel standard.

**V.120**—One of the terminal rate adaptation protocols for the ISDN B-channel. V.120 is more software-intensive than the V.110 B-channel standard.

**Videotex**—A two-way information-retrieval service that can be accessed by terminals and by a TV set (with installed decoder). Allows interactive retrieval of information pages from a central resource. See also *ISDN*.

**virtual circuit**—A logical connection. Used in packet switching wherin a logical connection is established between two devices at the start of transmission. All information packets follow the same route and arrive in sequence (but do not necessarily carry a complete address).

**X**

**X.25**—ITU-T's definition of a three-level packet-switching protocol to be used between packet-mode DTEs and network DCEs. X.25 corresponds with layer 3 of the 7-layer OSI model.

**X.75**—An ITU-T standard for linking X.25 packet-switched networks. X.75 defines the connection between public networks, i.e., for a gateway between X.25 networks.

# Index

## A


Abort timer 45
Answering a call 41
  Automatically 60
  Manually 60
Assembling the modem 13
AT commands
  !C0= 22, 31
  !C6= 31
  !D3= 32
  !L 32
  !N1= 33
  !RXG 33
  !TXG 33
  !Z= 34
  $D 39
  %A97= 31
  %E 40
  &C 36, 45
  &D 36, 44
  &E 37
  &F 29, 37, 38, 78
  &R 38
  &S 38
  &W 38, 39, 78
  &Z 39
  &Zn= 59
  &Zn? 59
  *!C6= 31
  *!D3= 32
  *!N1= 33
  +++AT<cr> 30, 40, 58
  <break>AT<cr> 30, 40
  @Config 42
  A 41, 60
  D 41, 58
  E 34
  ENTER key 30
  Entering 28
  H 41, 60
  I 41
  Implementing 30
  L 59
  L5 34
  L6 34
  Lack of response to 63
  O 41, 58
  Q 34
  Sr= 35
  Sr? 35
  V 35, 57
  X 35
  Z 35
AT commmands, configure the TA 21
Auto-protocol detection 48, 49
Autoanswer 41, 44, 60, 65


## B


B-channel
  protocol 9
Backspace character 44
BBS (bulletin board system) 71
Break signal 30


## C


Cables
  ISDN 64
  USB serial 63
Call control configuration 23
  Auto answer data calls 23
  Data protocol 23
  Dialing method 23
  Dialing number 23
  Dialing stored numbers 23
  Persistent DTR dialing 23
  Rings to answer 23
  Stored numbers 23
Caller Line ID CLI 48
Canceling a call 59
Carriage return character 44
COM port 63
Command mode 58
  Echo 34
Commands
  Answer 60
  Answer call 41
  Data MSN/DN 33
  Data SPID 31
  Data TEI 32
  Dial 41, 58
  Escape Sequence Options 40
  Flow control 37
  Hang up 41, 60
  Hook control 41
  List Active Profile 34
  List Telephone Numbers 59
  Load Profile 29, 38, 78
  Pacing 37
  Persistent DTR Dialing 39
  Read S-Register 35
  Receive Gain 33
  Reset 35
  Return Online 41
  Set S-Register 35
  Start ConfigMenu 42
  Store Active Profile 39, 78
  Store Telephone Number 39, 41
  switch type 22
  Transmit Gain 33
Communications programs 63

Compatibility
Switch 9
Configuration 42
AT commands 21
Dial-Up Networking (DUN) 21
Network configuration 21
Windows 98/95 21
with ISDN TA Configuration utility 21
Configuration profiles
ML-PPP asynchronous operation (Profile 4) 83
Modem-like asynchronous operation (Profile 0) 79
V.110 asynchronous operation (Profile 1) 80
V.120 asynchronous operation (Profile 2) 81
X.75 asynchronous operation (Profile 3) 82
Configuration utilities
Windows 98/95 24
Connectors 9
AUX 14, 64
ISDN 64
CTS (Clear to Send)
Signal 38
CTS Control
AT command 38

## D

Data mode 58
returning to 41
Data protocol
MLPPP 23
V.110 23
V.120 23
X.75 23
Data rates 9
Data Terminal Ready (DTR) 23
DCD (Data Carrier Detect) signal 36
DCD Control command 36
DCD drop time 45
Dial-Up Networking 21, 25
Dialing a Stored Telephone Number 41, 59
Dialing Method
AT command 31
Dimensions 9
Directory Number (DN) 22
Disabling a channel 32
Display Network Configuration commandI 32
Display Product Information command 41
Displaying a stored number 59
DMS-100 switch type 31
DN (directory number) 22, 33
Driver software installation
Windows 95 20
Windows 98 18
DSR (Data Set Ready) signal 38
DSR Control
AT command 38
DTR (Data Terminal Ready) 23
Dialing 39
Drop time 45
Signal 36
DTR (Data Terminal Ready) signal 39
DTR Control
AT command 36

## E

Echo commands 34
Embedded Protocol Analyzer 32
En bloc sending 31
Environmental conditions 9
Error correction 37
Escape character 30, 44
Escape sequences 58
In-band 30
Options 40
Out-of-band 30
Timeout 46

## F

Factory profiles 78
Firmware upgrade 73
FlashWizard, using 73
Flow control 66
Hardware 37
RTS/CTS 37
Front panel 62

## H

Hanging up a call 60

## I

Initialization strings 64
ISDN line 64
ISDN MTA128ST-USB Configuration utility 21, 24

## L

LED indicators 9, 62
128 Kbps 15
Bearer Channel 1 15
Bearer Channel 2 15
Data Protocol 16
Off Hook 15
Receive Data 15
Terminal Ready 15
Transmit Data 15
Line connection 14
Line feed character 44

## M

Making a call
Canceling a call 59
Channel bundling flag dialing 59
Dialing 58
Dialing a stored number 59
Displaying a stored number 59
Storing a telephone number 59
Manual organization 7
Maximum frame size (X.75) 49
Messages
Response 57
Microphone amplification 33
ML-PPP protocol 23, 78
dialing 58
Modes of operation 58

MSN (multiple subscriber number) 22, 33
MTA128ST-USB
Accessories, ordering 74
Assembling 13
AT Commands 25
Call control configuration 23
Configuration 21
Configuration profiles 78
Connecting to your system 13
Features 8
ISDN configuration utility 24
LED indicators 15
Modes of operation 58
Network configuration 22
Operation using AT commands 58
Product description 6
Regulatory compliance 76
Software installation 18
Technical specifications 9
Technical support 71
Troubleshooting 62
Unpacking 12
Windows 98/96 dial-up networking 25
Multi-Tech BBS 71
MultiExpress terminal 63
Multiple Subscriber Number (MSN) 22

## N

Network configuration
Data MSN 22
Data TEI 22
DNs 22
Network switch 22
SPIDs 22
Voice MSN 22
Voice TEI 22
Network switch type
AT command 31
Networkconfiguration 22

## O

Offline command mode 58
On-line warranty registration 70
Online command mode 58
Operating the MTA128ST-USB using AT commands
Answering a call 60
Hanging up 60
Making a call 58
Overlap sending 31

## P

Phone connection 14
Power
Consumption 9
Requirements 9
Strip 62
Supply 62

## Q

Quick setup factory profiles 38

## R

Rate adaption protocol
AT command 34
Reference materials 16
Regulatory compliance 76–93, 77
Remote node operation 21, 25
Removing a modem from Windows 21
Result codes 64
Connect messages command 35
Enable/disable command 34
Terse/verbose command 35
Rings
Count 44
Number before answering 44
Rings to answer option 23

## S

S-registers 35
Sending single multiple Xoff characters 37
Service 71
Service profile idenfiier (SPID) 22
Setup 78
Specifications, technical 8
SPID (service profile identifier) 22, 31
Stored number
Listing 39
Reading 39
Storing
Profiles 39
Telephone number 39, 59
Switch type 9
5ESS 31
DMS-100 31
Euro-ISDN 31
INS64 31
NET3 31
NI-1 31
VN4 31

## T

Technical support 71
TEI 22
TEI (terminal endpoint identifier) 32
Telephone, connecting a 14
Telephone numbers
Stored 39
Terminal Endpoint Identifier (TEI) 22
Terminal mode 63
Testing 62
Troubleshooting the MTA128ST-USB
3Com Sonix adapter originates a V.120 call but the 67
Can place data calls but not voice calls or vice v 64
Cannot connect when answering 65
Cannot place two simultaneous data calls 65
Data is being lost 66
Dials but cannot make a connection 64
Disconnects when online 65
Does not respond to commands 63
File transfer appears slower than it should be 65
None of the LEDs light 62
Receives garbage characters after receiving good c 67

Receives garbage characters when connected to a 3C 67
V.110 call, caller gets a NO CARRIER message 66
V.120 call, caller gets a NO CARRIER message 66
V.120 calls not accepted from a 3Com Impact IQ TA 66
Will not connect to an ELSA adapter with the V.120 67

## U

Uninstalling an MTA128ST-USB from Windows 21
Unpacking the MTA128ST-USB 12
Upgrade firmware, FlashWizard 73
USB evaluation utility 20
USB, overview 6

## V

V.110 protocol 23, 78
V.120 protocol 23, 78
Voice
Coding 9
MSN/DN command 33
SPID command 31
TEI command 32
Volume
Control 33
Speaker 33

## W

Wait for connection (Abort Timer) 45
Warranty 9, 70
Weight 9
Windows 98/95 63
Windows 98/95, uninstalling a terminal adapter 21
World Wide Web 16

## X

X.75 protocol 23, 34, 78